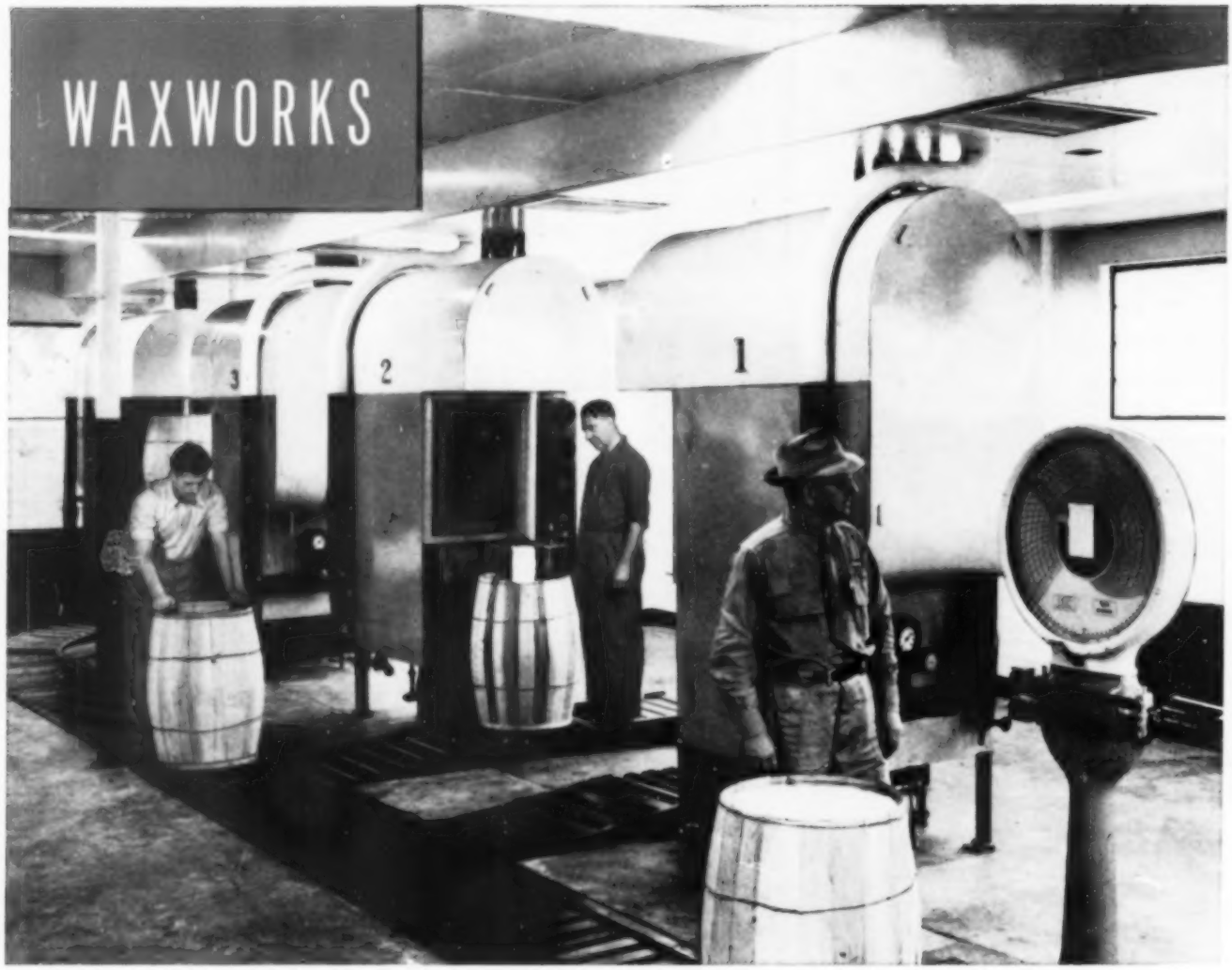
# CHEMICAL
## *& Metallurgical*
# ENGINEERING

**For MARCH, 1946**

**• NEW ENGINEERING TECHNIQUES USED IN PRODUCING NYLON YARN • CHEMICAL ENGINEERING PROFESSION HONORS A-BOMB PROJECT • MANGANESE MADE BY ELECTROCHEMICAL PROCESS • SWEET POTATO STARCH IN FLORIDA EVERGLADES • WHAT WAS NEW AT THE CHEM. SHOW • DESIGN OF AIR DUCTS FOR DUST AND FUMES**

*Nylon salt is polymerized at this Martinsville, Va., plant and at Seaford, Del.*

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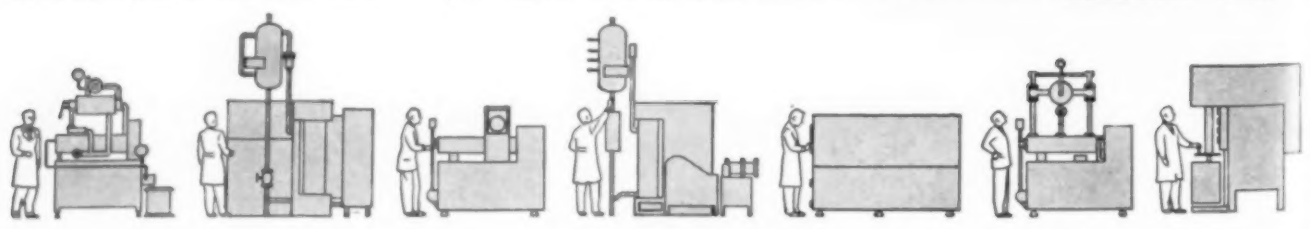

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# In this Issue





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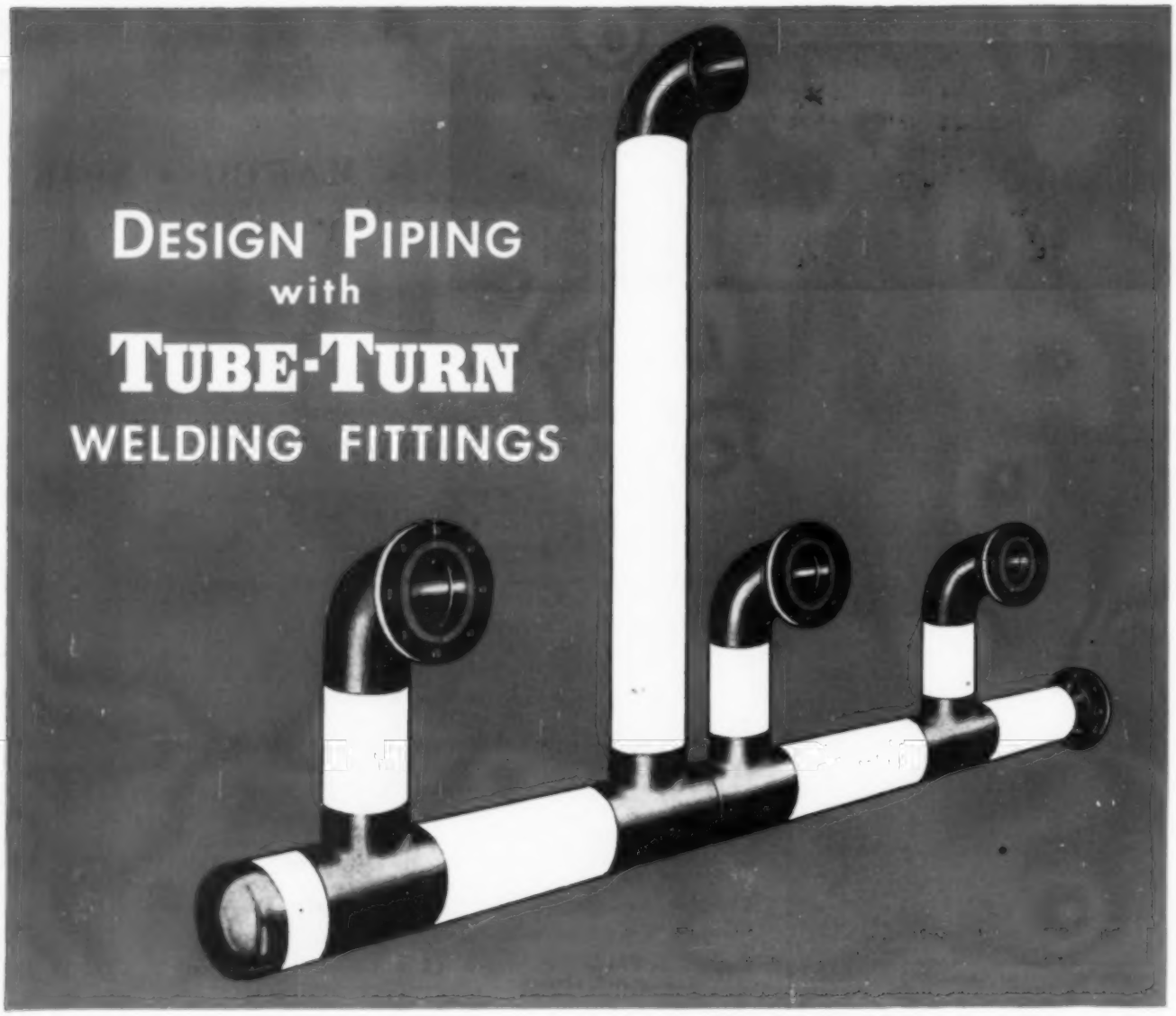


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ENGINEERING

ESTABLISHED 1902

S. D. KIRKPATRICK, Editor

MARCH 1946

# Atomic Engineering's Future

GRADUALLY the gripping story of the essential role of the engineer in translating the age-old dreams of the nuclear physicists into the stern realities of today is beginning to unfold. At the Award Dinner on February 26, P. C. Keith added materially to the excellent account we were privileged to publish in these pages last month. The great accomplishment, he pointed out, was due in no small measure to the fact that advances in American engineering have kept pace with the advances in science. In short, engineering became of age. "No longer is the engineer only the lean, bronzed, knee-booted extrovert who digs canals and flings railroads across the continents. Today he is also the myopic, scholarly introvert whose hair grows longer and longer each day. As the scientist seeks knowledge as an end in itself, this modern engineer seeks knowledge as a means to an end. Both use the same tools—only the application is different."

Because of this welding of science and technology "the halting steps of empiricism and back-of-the-envelope calculations" have given way to the "seven-league boots of mathematical analysis." Advances have been made by the quantitative application of fundamental principles of both chemistry and physics. Thus chemical engineering, which is based primarily on this trinity of sciences, came to occupy a key position in the atomic bomb project. Fully a third of its technical men were graduate chemists or chemical engineers.

With this much of recent history in mind, let us look briefly to the immediate future of "atomic engineering" or perhaps we should say with greater accuracy, "nuclear engineering." If the great progress we have made to date is to proceed apace, we must provide both the ways and means for continuing this closer association of fundamental science and chemical engineering. Part of this responsibility will undoubtedly be discharged by the nuclear-research institutions now being organized in several of our university centers. Another part must be done in the plants and laboratories at Oak Ridge and Hanford which most unfortunately are already losing some of their key personnel, especially their younger chemical engineers. That trend should, if possible, be reversed immediately. Manhattan District is already doing something about it by providing more attractive civilian jobs for capable engineers and administrators but it needs the help and support of our industries and the chemical engineering profession.

Still another approach that must not be overlooked is the necessity for legislation that will set up under the proposed Atomic Energy Commission a resourceful Division of Engineering, headed by an administrative engineer selected for his experience and ability in this important field. August C. Klein, engineering manager of Stone & Webster Engineering Corporation ably presented this viewpoint in a forceful statement before the McMahon committee on February 13. He showed that engineering and construction accounted for fully 90 percent of the entire cost to date of the project. But, more important, "that only by the inclusion of such a division can the Commission operate to best advantage in accelerating the development of atomic energy for domestic utilization and for maintaining the dominant position which the United States now holds in the production of fissionable material and its application."

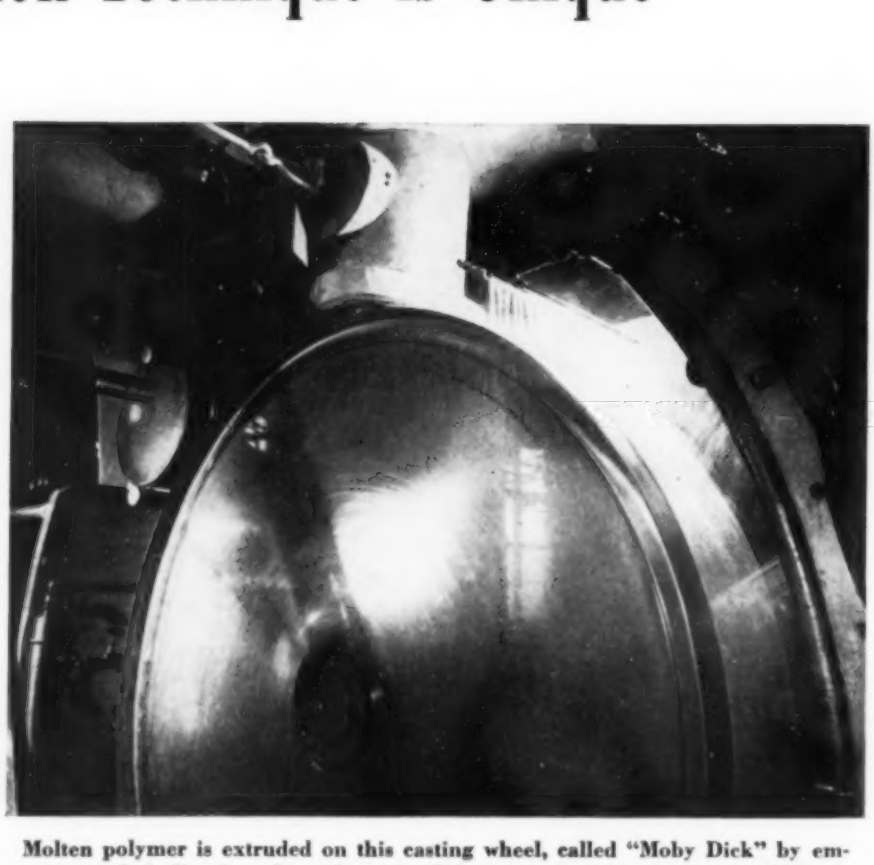
Let us, as a profession with most at stake, get squarely behind the whole program of building engineering strength and stability into the atomic energy structure. It will require articulate support not only by our technical and engineering organizations, but also by each of us as individual citizens who recognize our responsibility to the future of our country.

**JAMES A. LEE** *Managing Editor, Chemical & Metallurgical Engineering*

# NYLON

## Production Technique is Unique

**Nylon, the all-American development, has become one of the best known words in the English language and beautiful women the world over hold nylon stockings among their most prized possessions. But the manufacturing process is not so well known. From time to time descriptions of minor portions of the operations have been released for publication but never before has an editor been permitted to visit a nylon plant and describe the chemical engineering of the process of making the hexamethylene-adipamide polymer and the yarn. Nylon is entering a new era that may lead it during the next decade into an even more enviable position in the hosiery industry, into a variety of fine fabrics, plastic products and many other fields.—*Editors***



**Molten polymer is extruded on this casting wheel, called "Moby Dick" by employees of du Pont's nylon plants, and is sprayed with water to solidify it**

On Oct. 27, 1938, the E. I. du Pont de Nemours & Co. announced to the world the development of a group of new synthetic super polymers from which, among other possible applications, textile fibers could be spun surpassing in strength and elasticity any previously known. The polyamide from hexamethylene diamine and adipic acid first synthesized by the research workers of the Du Pont company in February, 1935, was considered the most promising, both from the standpoint of its properties and the possibility of manufacture on a commercial scale.

Since both the amine and the acid contain six carbon atoms in the molecule, the polymer was identified as polymer "66." By late 1937, a process had been developed for manufacturing intermediate materials needed in making polymer and a "semi-works" plant began operating at Belle, W. Va. A pilot plant to produce bristles and textile yarn was completed at Wilmington in the summer of 1938. Commercial manufacture of nylon yarn started at the Seaford, Del., plant in December, 1939, and the second yarn plant went into operation at Martinsville, Va., in November, 1941. The original semi-works for making nylon chemicals at Belle, having been increased to a full-scale plant in 1939, is being further augmented by a second full-scale plant now under construction near Orange, Tex. Conversion of the chemicals into yarn at the Seaford plant will be described here.

Five different modifications of polymer "66" are in commercial yarn production. They vary in viscosity and in delustrant. Some are pigmented, others are bright or non-pigmented.

### NYLON SALT

The Belle plant makes the hexamethylene diammonium adipate, or "salt" as it is more commonly spoken of by the operators. To facilitate its handling and shipment to the yarn plants the salt is made into a water solution. On arrival at Seaford in tank cars, the solution is pumped into any one of the large horizontal storage tanks located out of doors. One end of each tank extends into the processing building. Valves, pumps and indicating equipment used in connection with the solution are on the inside of the building where they are protected from the weather. If the temperature

rises too high the solution oxidizes and changes color, while on the other hand if the temperature falls too low, of course, the salt crystallizes out.

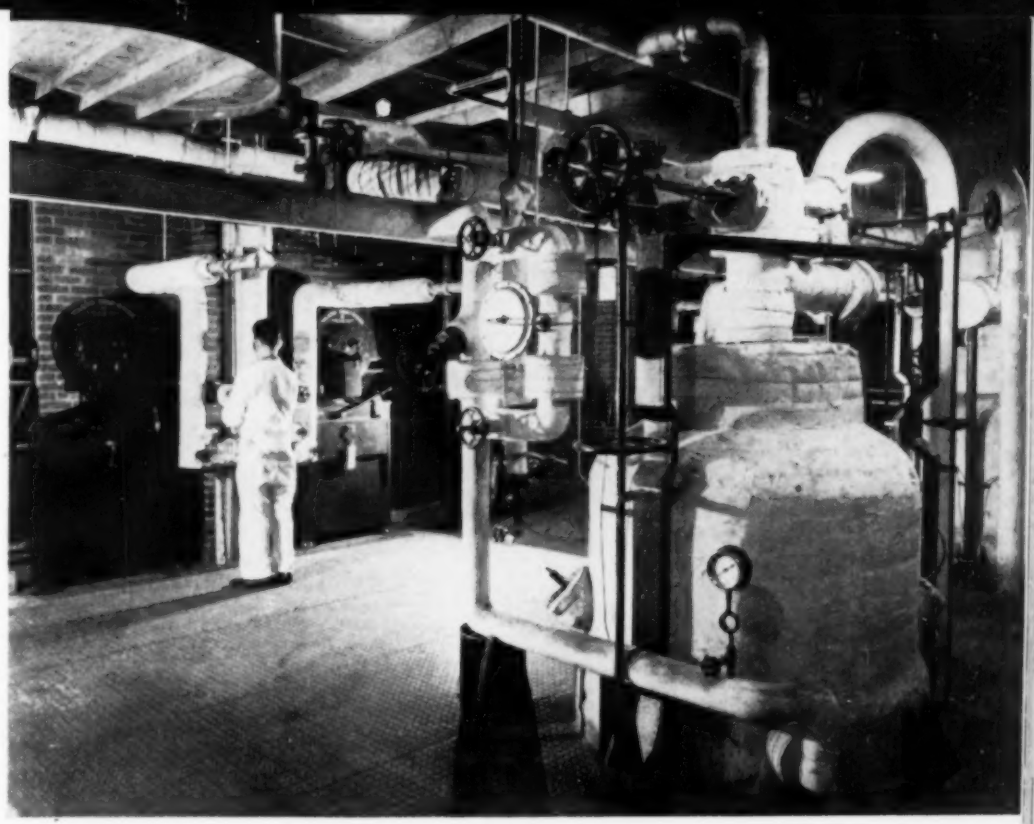
Conversion of the salt into nylon is carried out in many steps or stages: (1) Evaporation of the water in which the salt is dissolved; (2) polymerization of the material; (3) extrusion of the polymer onto a casting wheel; (4) chipping the hardened material; (5) blending; (6) melting the chips; (7) spinning; (8) drawing to develop strength and elasticity; and the numerous operations associated with the handling of any type of yarn.

## EVAPORATION

First of all the salt solution is pumped through a stainless steel pipe line from storage on the first to the sixth floor where a batch is measured in a printed weight scale tank. The batch is divided equally between two evaporators, kettles containing tube chests in the bottom, and evaporated at atmospheric pressure.

Acetic acid is added to the evaporator charge in order to stabilize the viscosity since any monovalent reactant will interrupt the polymer formation. The acid is measured on scales near the top of the evaporator and then added through a funnel and lock device.

When action in the evaporator has stopped, the salt solution is allowed to flow by gravity through a manifold to the autoclave below. During this transfer the pressure is balanced between evaporator and autoclave. Each pair of evaporators serves six autoclaves. The autoclaves are jacketed and are equipped with internal coils. They are heated by Dowtherm vapor, a boiler is used for each autoclave. Operation of the autoclave is divided into five periods in which the Dowtherm pressure varies from one period to another. The pressure maintained in the operation depends upon the type of polymer desired. Recording instruments are used on the Dowtherm temperature and on the polymer mass.



**Nylon salt solution is pumped from storage to evaporators on the sixth floor. Acetic acid is added to stabilize the viscosity**

The action of the autoclave is two-fold: (1) There is evaporation of water in which the salt is dissolved; and (2) polymerization. They are filled at the start with specially purified nitrogen under 40 to 50 lb. pressure. Heating is continued until a specified pressure is reached, meanwhile steam is bled off. Soon after the mass has commenced to boil a titanium dioxide dispersion in distilled water is added to the contents of the autoclave through a locking device so as to prevent the entrance of air. To obtain best spinning performance the pigment must be very thoroughly dispersed.

As evaporation and elimination of the water progress in the autoclave the temperature increases steadily. Finally a point is reached where the pressure is reduced slowly by automatic control to atmospheric pressure. Heating of the polymer is continued while the pressure is being reduced so that when the reduction is complete the temperature of the mass is above the melting point. The polymer is retained in the autoclave for a definite period in order to complete the reaction.

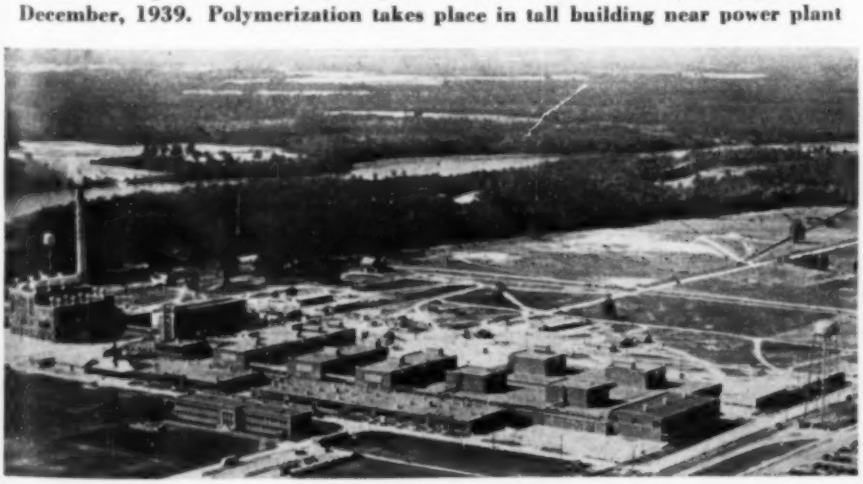
When the polymerization has been completed the extrusion valve on the bottom of the autoclave is opened. Nitrogen at a pressure of 40 to 50 lb. is introduced into the autoclave and forces the sirupy material to flow from a slot in the bottom.

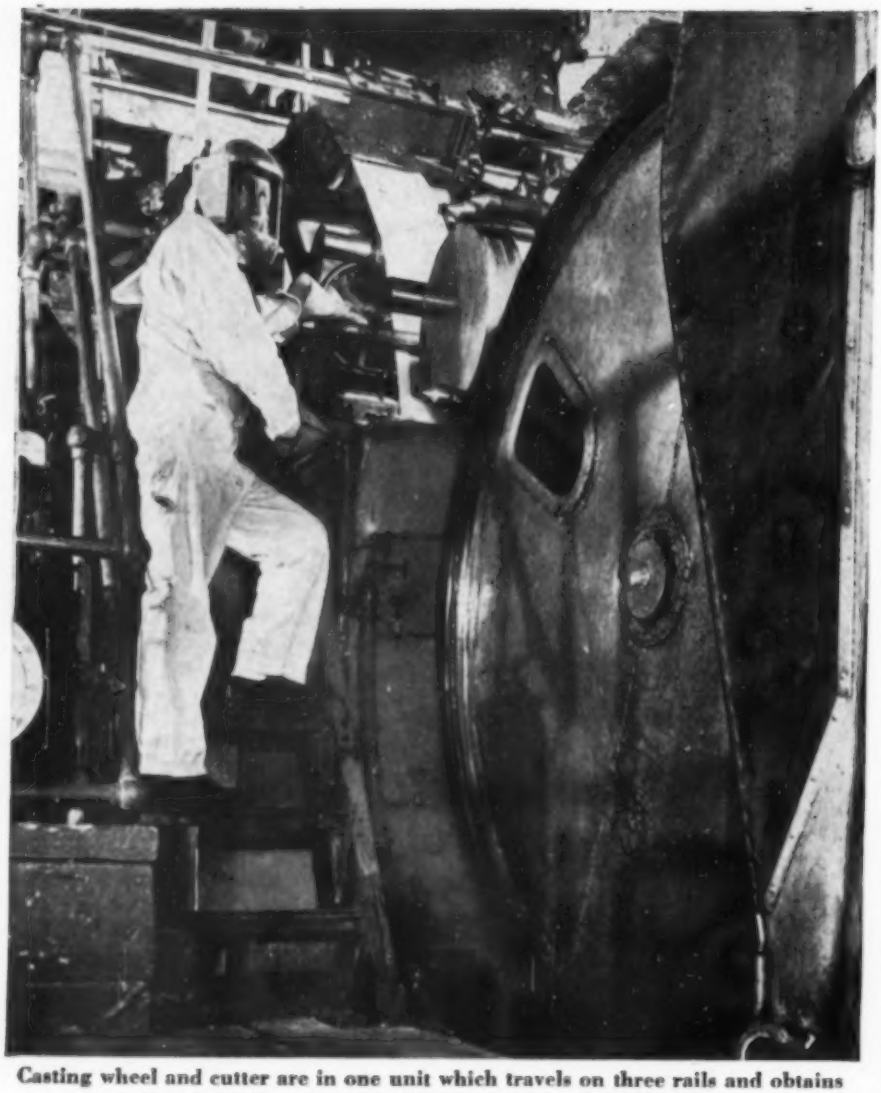
## CASTING

The extent the extrusion valve of the autoclave is open controls the subsequent operation. About an hour is required to extrude a 2,000 lb. batch.

A ribbon of the polymer about one-quarter of an inch thick and 12 in. wide flows onto the surface of a broad, slowly revolving casting wheel. The wheel and cutter are in one unit which travels on three rails and obtains its power for operation from an overhead fourth rail. One of these units serves several autoclaves. The casting drum is about 6 ft. in diameter. Three sprays of water strike the top surface of the polymer on its journey around the drum and water on the inside of the wheel cools and hardens the underside of the ribbon of polymer. The operator threads the ribbon around the wheel, then through a loop, permitting a festoon to form and finally to the cutter. As the hardened, translucent, milky-white ribbon leaves the drum it is further cooled by means of a stream of air

**Commercial production of nylon yarn started at the Seaford, Del., plant in December, 1939. Polymerization takes place in tall building near power plant**





**Casting wheel and cutter are in one unit which travels on three rails and obtains its power for operation from an overhead fourth rail**

which also serves to blow off the surface water.

A cutter reduces the polymer ribbon to small chips or flakes. These fall into a portable receiver which is equipped with a screw for blending. Each receiver holds an autoclave charge. Air is drawn through this blender to assist in the drying. A dust collector recovers the small amount of fine particles.

The material in the receiver is sampled and the moisture, viscosity and color is determined. It then goes into a stationary or storage blender in which two or more batches are mixed together by means of a screw device. These blenders are kept tightly sealed since the warm nylon takes up moisture rapidly from the air. Successful and smooth operation requires very close scheduling.

The buttons of the storage blenders extend through to the floor below where chutes from them empty into transfer hoppers operating on a monorail. The polymer is conveyed to individual supply hoppers which feed the polymer to the spinning unit.

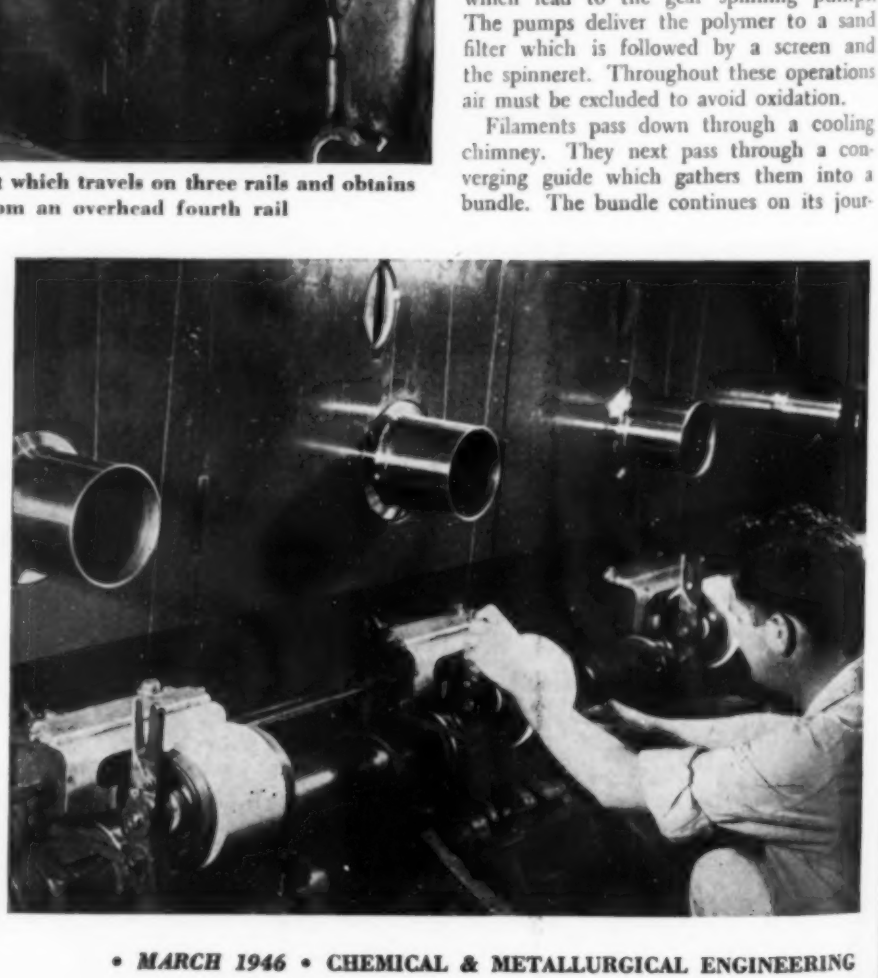
Precautions are taken to remove all oxygen from the supply hoppers. They are first evacuated and then filled with nitrogen. The nitrogen is of a special purified grade made on the premises and piped into the nylon plant. A portable rotameter is used to check spinning machine consumption periodically.

## SPINNING

When the supply hopper has been freed of oxygen and loaded with polymer, the plug cock is opened permitting the flake to fall by gravity into the spinning unit which is composed of a metal block surrounded by a Dowtherm vapor-heated jacket. This keeps the temperature of the metal block above the melting point of the material. In this block there is a Dowtherm vapor-heated grid. When the flake comes in contact with the grid it melts and dribbles through to a melt chamber, which is a small reservoir below.

From this chamber there are port holes which lead to the gear spinning pumps. The pumps deliver the polymer to a sand filter which is followed by a screen and the spinneret. Throughout these operations air must be excluded to avoid oxidation.

Filaments pass down through a cooling chimney. They next pass through a converging guide which gathers them into a bundle. The bundle continues on its jour-



**Nylon yarn, after the fine filaments extruded from the spinneret have been brought together, is wound on bobbins and sent to textile area of the plant**

ney passing through a chamber in which the yarn is humidified by steam in order to bring its moisture content up to equilibrium. The moistened yarn passes over a glass finish roll which applies an oil emulsion. This serves as a lubricant in subsequent operations and also to bind the filaments together so that the wind-up package will be more stable toward deformation.

The yarn is stretched or drawn to the desired degree by running it through a system of rollers in such a manner that it is extended to four or more times its original length, depending upon the particular polyamide being processed. A highly interesting phenomenon occurs during this stretching operation. The long, chain-like molecules which make up the undrawn fiber are arranged in a helter-skelter fashion but on drawing orient themselves. It is this operation that develops the strength and elasticity characteristic of nylon.

In order to handle the knitted hosiery it is necessary that the yarn be sized with some substance which will cement the loops in the knitted fabric and thus give a stiff fabric which can be handled easily during subsequent manufacturing operations. The finding of a suitable sizing material proved to be one of the most difficult problems encountered in the entire development by the research organization of the Du Pont company. The requirements are that it be applied to the yarn from an aqueous solution, yet it should not soften sufficiently when run through the knitting machine in a wet condition to scrape off on the knitting needles. However, it must be sticky enough to cement the loops of the fabric together as the fabric is knit and must boil off in the subsequent aqueous bath processing of the knitted hose. One solution to the problem is a size consisting of a mixture of polyvinyl alcohol and boric acid.

**Here the nylon yarn is sized as it winds from one package to another; after giving protection in subsequent operations, the size coating is removed**

## MATERIALS OF CONSTRUCTION

Equipment was unusually costly due to the large amount of expensive alloys that were required to resist not only possible corrosive conditions but the even more exacting tarnishing conditions. As the chemicals to be handled were new there was no previous experience upon which to base the selection. The Du Pont engineers decided to specify the best materials of construction available since even the discoloration product that would be caused by tarnishing would be detrimental. As a result of the adoption of this policy the processing equipment throughout the main plant was all fabricated from stainless steel with the exceptions of the material storage tanks and the supply hoppers for the spinning machines which are aluminum.

Since the plant first went into operation considerable knowledge of the corrosion and tarnishing resistance of many metals and alloys to the polymer has been gained which has made it possible when building additional facilities to use less expensive materials.

## RECOVERY OF WASTE YARN

It may be of interest to describe the adjoining plant used for the recovery of the waste nylon yarn. Characteristics of yarn made from the recovered material are the same as those of yarn made from virgin polymer.

The recovery process was developed for wartime purposes when the armed services were greatly in need of every bit of nylon they could get, but present prospects are that it will be continued in operation for some time to come. The process elements consist of digesting nylon wastes with a 50 percent sulphuric acid solution which hydrolyzes the nylon to adipic acid and hexamethylene diammonium sulphate. The mixture is cooled and the adipic acid crystallized out. The resultant crystalline slurry is centrifuged in a rubber-lined centrifuge to remove the crystals and returned to a lead-lined digester in which it is cooked again in order to carry the reaction closer to completion. This operation is twice repeated. Then the adipic acid is decolorized with activated charcoal, the solution filtered in a stainless steel filter press and the acid recrystallized in glass-lined vessels. The effluent from the centrifuge, a solution of hexamethylene diamine and sulphuric acid is mixed with a lime slurry which neutralizes the acid.

A precipitated calcium sulphate is formed which is centrifuged off leaving a dilute solution of diamine (7 percent concentration). This is fed continuously to a bath still where it is concentrated to 75 percent. The remaining water is then taken off and the diamine is distilled at a reduced pressure. The diamine and adipic acid are combined to form 66 salt.

It is interesting to note that due to wartime pressure for additional nylon output the recovery process went directly from the laboratory to commercial scale without the customary pilot plant intermediate stage.

While the foregoing description has had to do principally with nylon yarn production, polymer 66 and other superpolymers are made for toothbrush and paint brush bristles, surgical sutures, fishing leaders, molded plastics and many other products. Nylon is entering a new era that may lead it during the next decade into an even more enviable position in the hosiery industry, into a great variety of fine fabrics, and numerous other fields.

Readers are referred to pp. 148-151 for a pictured flowsheet of nylon production.

# Chemical Engineering Profession Honors A-BOMB PROJECT

**Almost 2,000 members and guests of the chemical engineering profession met at a colorful dinner in New York February 26 to present the seventh biennial Award for Chemical Engineering Achievement to more than a hundred companies and universities that contributed most to the Atomic Bomb Project. Chairman White of the Award Committee presented a symbolic scroll to General Groves who accepted it on behalf of the Manhattan District and its prime contractors in science, engineering and industry. President James B. Conant of Harvard outlined the role of the civilian scientists in the great cooperative project and P. C. Keith of Hydrocarbon Research, Inc., portrayed the important parts played by 9 engineers and industrialists—*Editors***

**Alfred H. White, Chairman of Committee of Award presents symbolic scroll to Maj. Gen. Leslie R. Groves, Commanding General of Manhattan Engineer District**

## Presentation of Award

ALFRED H. WHITE *Chairman of Committee of Award, Professor Emeritus Department of Chemical and Metallurgical Engineering, University of Michigan, Ann Arbor, Mich.*

TONIGHT we honor those who played a major part in the most remarkable technological achievement of the human race. Only a few fundamental facts about atomic fission were known when this project was commenced. Physical constants, energy changes, and methods of separation had to be determined in research laboratories with incredible accuracy, although only minute quantities of material were available for experimentation. Engineers studied the fundamental data of the scientists and developed manufacturing processes to produce the needed materials by feasible methods.

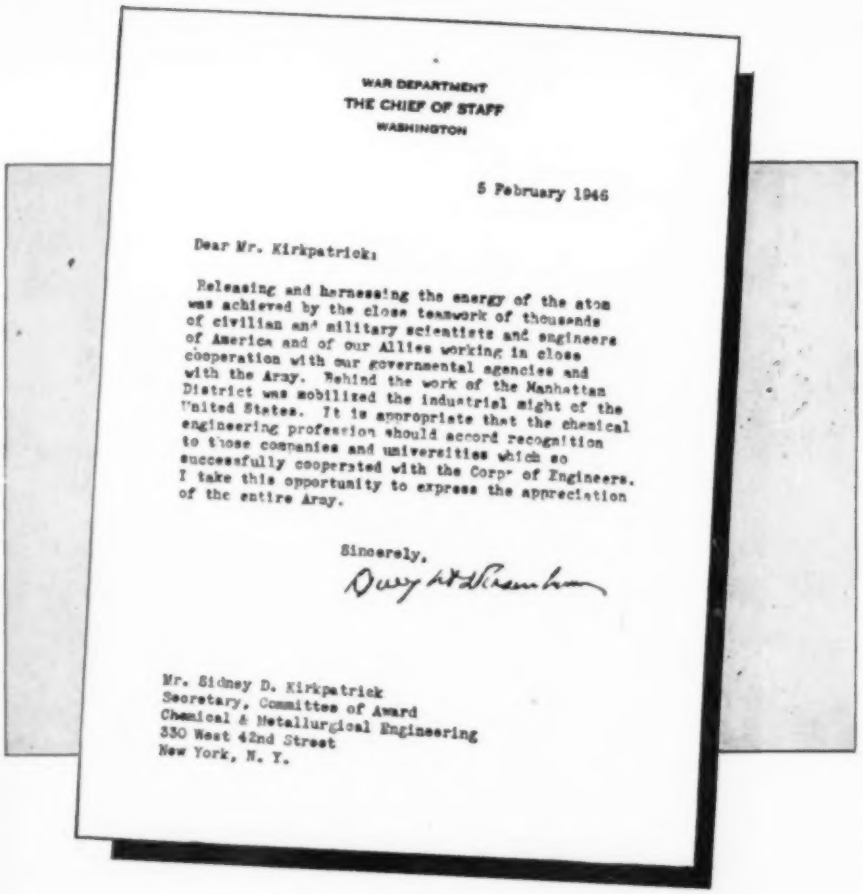
Normal caution would have dictated slow and gradual development, but the project was undertaken in a period of national emergency which made haste imperative. The scale of operations was increased a million fold at a single stroke. If there had been a serious flaw in a single link of the complicated chain of development which began with the theoretical physicist and extended to those who assembled the atomic bomb, success would have been delayed greatly and perhaps might never have been attained.

We know the names of only a few of the many individuals who contributed to this splendid result. But no individual and no number of individuals working separately could have achieved this success. It came through the action of coordinated groups.

Groups skilled in research, development and design joined forces with corporations which had knowledge, facilities for fabricating great manufacturing plants and vision to foresee and obviate difficulties which would attend the operation of difficult and dangerous processes. These groups were backed by the full war-time powers of the federal government and they all worked together under military direction with an intensity that produced this wonderful chemical engineering achievement in an incredibly brief time.

The coordinating, directing center of all these efforts was the Manhattan Engineering District. That office has indicated to our committee the names of the companies and universities that made major contributions to the research and engineering phases of this achievement. We hail them not only for their success in producing the atomic bomb which forced Japan to confess defeat, but for their production of a new source of energy and of new chemicals which will bring great and perhaps revolutionary benefits to a world at peace.

General Groves, on behalf of the Committee of Award, I present you as leader of the Manhattan Engineer District and to the groups which made major contributions to the development of atomic energy, this scroll symbolizing the Seventh Biennial Award for Chemical Engineering Achievement.



WAR DEPARTMENT
THE CHIEF OF STAFF
WASHINGTON

5 February 1946

Dear Mr. Kirkpatrick:

Releasing and harnessing the energy of the atom was achieved by the close teamwork of thousands of civilian and military scientists and engineers of America and of our Allies working in close cooperation with our governmental agencies and with the Army. Behind the work of the Manhattan District was mobilized the industrial might of the United States. It is appropriate that the chemical engineering profession should accord recognition to those companies and universities which so successfully cooperated with the Corps of Engineers. I take this opportunity to express the appreciation of the entire Army.

Sincerely,

Dwight D. Eisenhower

Mr. Sidney D. Kirkpatrick
Secretary, Committee of Award
Chemical & Metallurgical Engineering
330 West 42nd Street
New York, N. Y.

**General of the Army Eisenhower extends appreciation to the companies and universities that shared in the success of the Atomic Bomb Project.**

# Acceptance of Award


## MAJOR GENERAL LESLIE R. GROVES

*Commanding General of Manhattan Engineer District.*


THANK YOU very much Colonel White. It is with a deep appreciation of its significance that I accept this award for chemical engineering achievement on behalf of the 500,000 Americans who earned it. I also wish to accept it on behalf of the Manhattan Engineer District, and the engineering, industrial and academic organizations which, with the wholehearted assistance of many supporting agencies, were responsible for the successful development of the atomic bomb and the early and unexpected ending of the war with Japan.

The success of the Manhattan Project was due to the cooperation and teamwork of the hundreds of thousands of individuals and the thousands of organizations engaged on our work. Each individual, each specialized group, each contractor, each university contributed to the final achievement. The program for tonight's dinner lists the names of more than 100 of the principal contractors. I should like to emphasize that there were besides these principal contractors many thousands of sub-contractors, many of whom played key roles in the accomplishment. It is impossible to state which organization was the most important. To attempt to do so would be like attempting to decide which consecutive five rungs of any ladder are the most important. In many instances the work of a single group and even of a single man was vital to success. For if one of these groups had failed in its particular task, the whole Project would have failed even as the strongest chain fails when any one of its links is broken. Everyone who has been connected with this Project can and does feel justifiably proud of its success.

The Manhattan Project is so vast, so complex, and each field so highly specialized that the general public can never fully understand and appreciate the magnitude of the coordinated effort or completely evaluate the specific contribution made by science, industry, management and engineering that culminated in its success. The nation as a whole is unaware of the relative contribution made by the various groups and it will take many years before there is a general understanding of the important part played by many unheralded groups. For example, at the present time little is known of the important part played by the 5,000 enlisted men and women in the Manhattan Project. These enlisted men and women contributed greatly to all phases of the work, not only in the normal government phases but also with contractors on the scientific, engineering and industrial phases. The work of the enlisted personnel was vital to our success.

One phase of the Manhattan Project which has not received the public acclaim which it deserves has been the successful accomplishment of the chemical industry, the research chemist, the chemical engineer designer, and the chemical phases of our operations. This award brings the public attention to the work of this highly-trained group of men and women. As scientific historians of the future become aware of the nature and complexity of the problems solved by the Manhattan Project during the progress of the work, they will wonder, as I often do, how it was humanly possible for us to have succeeded. Some of those present will doubtless remember many blind alleys which we explored only to find that they were of no value. To those who devoted their efforts to these blind alley explorations may I express the same appreciation as to those whose work resulted in the successful features of the Project. I am proud of the fact there were so few blind alleys and that on the whole we dropped them as promptly as we did. For the benefit of those present who are not familiar with the background and history of the Project I should like to recount a few of the high lights.

In 1939 and 1940 nuclear scientists the world over really became excited over the significant possibilities inherent in the theory of the equivalence of mass and energy. They knew that the nucleus of some of the uranium atoms could be split, and that this splitting, or fission, to those of you who have read the Smyth report, would be accompanied by the release of a relatively enormous amount of energy. It was known that the fission of uranium could be initiated by neutrons coming from outside the atom and that the fission itself would produce additional neutrons. It was thought that it might be possible to produce a multiplying chain reaction that would develop tremendous explosive force. The surface of nuclear knowledge had barely been scratched.

By the end of 1941 a realization that the potentialities of nuclear weapons were such that their development by the enemy might at any time end the war adversely to us, led to serious consideration by the President and his advisors of the advisability of making an all-out effort to develop such weapons for ourselves.

In June of 1942, Dr. Bush, the Director of the Office of Scientific Research and De-

(*Continued on page 104.*)

*Chemical Engineering Award Dinner to*

THE MANHATTAN ENGINEER PROJECT

NEW YORK, FEBRUARY 26, 1946

*Sponsored by Chemical & Metallurgical Engineering*

DRUCKER-HILBERT PHOTO

velopment, sent a formal report on the project to President Roosevelt. The report summarized the scientific status of the uranium project as it then existed. It stated that an explosion equal to many thousands of tons of TNT might be caused to occur at a desired instant; that the desired explosive material might be produced by any one of four different methods; and that no one of these methods could be regarded as superior to the others. In addition, it stated that in order to accomplish the desired result in this war it was essential to bring in the Army Engineers. President Roosevelt approved the report and the Manhattan Engineer District was established. In September, I was assigned to direct the Project.

## CHANCE OF SUCCESS

In the fall of 1942 the chances of success could not be calculated. At that time it was possible only to guess at the eventual outcome of the entire Project. The first study of the problems confronting us brought to light a number of important questions to which no answers were immediately available. A few of these I will give you to illustrate the complete lack of information available to any of us at the outset: first, would we be able to develop any workable process for the separation of the basic materials involved; second, having developed such a process would it be adaptable to large-scale production methods even with the best of American skill and equipment; third, having built plants for the production of the necessary materials were there individuals or groups sufficiently ingenious to operate these installations with any degree of success; and finally would the materials actually explode with sufficient force to be truly devasting and thus effective in bringing about an immediate cessation of hostilities. You may readily see that seeking correct answers to the few questions which I have mentioned would inevitably involve a great number of individuals and major organizations and would require all the time that was available to us.

We knew that research, development, engineering, design, construction and operation had to be carried on simultaneously, that the sound industrial practice of using pilot plants to workout our processes could not be followed for lack of time. We decided to go ahead. We hoped for success but we knew it was far from certain.

Shortly after I was assigned to direct the activities of the Manhattan Project, I submitted my first report to General Marshall. This report, among other things, indicated that I considered our chances of success at that time to be an unknown quality. Only one thing was an absolute certainty. I was convinced that this undertaking would cost hundreds of millions of dollars and the American people must be prepared to gamble this huge sum on the possibility of our being able to produce a satisfactory atomic weapon. I knew that if such a weapon had the power which had been predicted, the first nation to employ it would win the war without further appreciable effort. At that time we knew little or nothing about German progress in the development of an atomic weapon. It was thought that the Germans might be as much as a year ahead of us. I knew that our bomb must be ready in time to bring the war to a close. I considered that we had a 60 percent chance of success. Our ultimate chance of success given unlimited time was as high as 80 or 90 percent. I realized that this was our opportunity to develop an atomic weapon. Such a development, with the cost and great risk involved, would never be undertaken by this country in time of peace. If we passed up this opportunity to lead the world in the development of atomic energy it was reasonable to assume that some other nation would develop these weapons first. If certain groups who had been, or who may in the future, be in control in certain foreign countries should gain possession of the only atomic weapons in the world they would undoubtedly destroy us and dominate all of the nations of the Earth. With these facts facing us I recommended that we go ahead with all possible speed. The Military Policy Committee, Dr. Bush, Dr. Conant, Admiral Purnell and General Styer agreed with my views. I insisted that this job must be assigned top priority over all other projects then underway or which might later be authorized, this priority to include personnel, materials and equipment of all types. My recommendations were approved by General Marshall, Secretary Stimson and President Roosevelt.

## EARLY DEVELOPMENT

Until this time the problem had been one for the research laboratory. A great many theories had been advanced and indeed many had been proved by actual laboratory tests. There appeared to be four possible methods of separating U-235 from its basic ore, and in laboratories research personnel had succeeded in separating minute quantities of U-235 from the more abundant isotope, U-238. The amounts of U-235 thus separated were measured in micrograms, they were not even sufficient for laboratory experiments.

It was also thought that if U-238 captured a neutron it would undergo changes in its atomic structure, and that an entirely new and, it was hoped, stable element might be formed. Thus was the origin of plutonium, an element not definitely known to occur in nature. Its significance was that plutonium might also have fissionable qualities like U-235 and that, as a different element, we might better be able to separate it from contaminating materials.

With the decision to push research and development of the uranium project also came the first of many tests which were to try the skill and patience of the chemical engineers.

The earliest problem, and perhaps one of the biggest problems, was to adapt strictly laboratory methods, for the production of microscopic quantities to factory methods for the production of the material in adequate amounts. Where researchers had formerly dealt with micrograms of U-235 and U-238, we now needed kilograms. Where a process of separation had formerly been carried on in what would correspond to a large college chemistry laboratory, we now had to design, engineer, construct and operate a separation plant which turned out to be four stories high and almost a mile from end to end. This was one of our three major processes. The gaseous diffusion process was developed at Columbia University and by the Kellex Corp. under the direction of Dr. Harold Urey and Mr. P. C. Keith, respectively. The plant at Oak Ridge was constructed by J. A. Jones Construction Co., Inc., and operated by Carbide & Carbon Chemicals Corp. The electromagnetic process had been developed at the University of California under the direction of Ernest O. Lawrence. For the application of this process, the Stone and Webster Engineering Corp. was chosen to engineer and construct the plant, also at Oak Ridge, and the Tennessee Eastman Corp. was selected to operate it. The Metallurgical Laboratory of the University of Chicago was established under the direction of Dr. Arthur H. Compton to develop the plutonium process. Its findings resulted in the Hanford Engineer Works, in the State of Washington, engineered, built and operated by E. I. du Pont de Nemours & Co. A minor, to us, process, for thermal diffusion, was developed at the Naval Research Laboratory under the direction of Dr. Ross Gunn and Dr. P. H. Abelson; it was engineered, built and operated by the H. K. Ferguson Co. at Oak Ridge. Why, you may well ask, did we construct several different types of plants each employing different methods? It was because we could not afford to be completely stymied due to a possible dead end in any one process, and we expected such dead ends to occur. We hoped that we could win out in time with at least one of the processes. Actually we succeeded with all three.

Chemical engineers met and solved many problems in the development of the processes for separating the isotopes of uranium, but, when the production of plutonium was begun, an entirely new field of chemistry and engineering was opened. Its chemistry, physical properties and constants were new to all of us. We had to learn about this new element by constant research as we were able to produce it only in minute quantities. We had to develop chemical processes for separating and concentrating

the plutonium from the radioactive fission products which contaminated it, and these processes all had to be operated by remote control. In dealing with the problems arising from the production of plutonium the ingenuity and skill of the chemical engineers were challenged to the utmost, but they met and successfully solved each problem as it arose. When we realize that chemical experiments using less than 1-millionth of an ounce of plutonium were the bases for the design, construction and operation of a $350,000,000 plant, we can indeed say that the chemical engineers of America were successful.

## WELL-DESERVED TRIBUTE

The public recognition which is being given to the chemical engineering profession here tonight is indeed a well-deserved tribute, and one which I know gives each of you receiving this award a great deal of personal satisfaction in knowing that a job well done has been recognized. Moreover I believe that all of you will share with me a deeper satisfaction in feeling that our efforts and eventual success saved many thousands of American lives.

The war was not won by the atomic bomb. It was won by the superior fighting qualities of our men backed by the best of weapons provided for them by the industrial might of our nation. The Japs had lost the war long before the Hiroshima bombing, but the Japanese people did not know it and their leaders would not admit it. Both people and leaders knew it and admitted it within a few hours after they learned of Hiroshima. It serves no useful purpose to discuss the various claims as to what won the war; the historians will argue that for centuries but I believe these same historians will be unanimous in the conclusion that the atomic bomb ended it in a most abrupt and sudden manner. I should like to give you a brief timetable of events:

1. 16 July 1945
   **On the 16th of July 1945, the first atomic bomb was detonated in New Mexico. After almost three years and almost two billions of dollars we knew for the first time that it could be done. I personally thought of the many conferences, sales talks I believe some of you called them in your more polite moments, that brought you into the project. When I talked in Washington on my return I no longer dealt in fancies but in facts.**
2. 26 July 1945
   **Ten days later the heads of the governments of the United States and of the United Kingdom, then meeting in Potsdam, drew up and issued a Surrender Ultimatum which was signed by the President of the United States and the Prime Minister of the United Kingdom and concurred in by the President of the National Government of China. This ultimatum warned Japan that she would be bombed out of existence if she continued the useless fight.**
3. 29 July 1945
   **Three days later, on the 29th of July, Japanese Premier Suzuki, at a cabinet press conference, scorned the Allied Potsdam Surrender Ultimatum "as unworthy of official notice" and tossed into the laps of the Mikado's military leaders the complete responsibility for the defense of the empire.**
4. 6 August 1945
   **On August the 6th, 1945, three weeks after the initial test in New Mexico, an atomic bomb was dropped on Hiroshima. American radio broadcasts, followed by propaganda leaflets dropped on their homeland gave the Japanese the first clue as to what had really happened to Hiroshima.**
5. 8 August 1945
   **On August 8th, Russia declared war on Japan.**
6. 9 August 1945
   **On August 9th, Nagasaki was hit by another atomic bomb**
7. 10 August 1945
   **On August 10th, the Swiss Charge d'Affaires sent a note to the Secretary of State stating that the Japanese Government ,was ready to accept the terms of the Potsdam Declaration.**
8. 14 August 1945
   **On August 14th, the Japanese Government accepted unconditionally the terms of the Potsdam Declaraton.**
9. 1 November 1945
   **November 1st was the scheduled date for the invasion by American troops on the Japanese homeland. The estimates as to the expected casualties varied but they were of the order of a million.**

In brief after almost four years of war, Japan surrendered eight days after the first atomic bomb was dropped on Hiroshima.

In New York people like to look at the record. I believe this is a record that speaks for itself, a record in the attainment of which the chemical industry played a most important role.

Atomic energy, though still uncontrolled, can now be released on a tremendous scale. Moreover, the prospect of controlling and using this energy for industrial purposes promises a far-reaching advancement in our civilization. Continued research and development must go on to devise ways of converting this untold energy into useful work.

We know now that secondary research as a result of our work has uncovered radioactive byproducts which will be invaluable in scientific, medical and industrial development and progress. The benefits to industry alone—the new engineering principles, precision equipment and revolutionary techniques developed during the production of the bomb—are enormous. And as our work progresses further discoveries and improvements are certain.

With the knowledge that the proper use of nuclear energy can provide these benefits, we must determine to utilize these scientific and industrial discoveries in the peaceful advancement of the welfare of our nation and of that of the rest of the world. We must maintain our lead position by aggressive leadership in scientific and industrial research. To succeed, we must capitalize on the unfettered initiative and ingenuity of American science and industry, which have brought us our present success.

We all ardently hope that our discoveries in the field of atomic energy can and will be used in a world that has peace. An effort is now being made by the United Nations Organization and by the diplomats of the world to attempt to bring about this desired peace. It must always be remembered that atomic energy is capable of being developed into a military weapon, the most powerful and devastating weapon that the world has ever known. Such a possibility cannot be separated from peacetime use.

## WHAT TO DO WITH IT

The congress has been studying, since October 9th, the problem of what to do about atomic energy. We hope that appropriate domestic legislation will be enacted which will insure that the problem will be well handled. The possibilities of the development of nuclear energy for other than war purposes should be fully protected. But until peace and desire for peace truly reigns in men's hearts throughout the world we must remember that the use of atomic bombs will always be a possibility. We must not allow wishful thinking to dictate national suicide.

I do not worry about whether the American people want peace, I know they do.

You may recall the nationwide campaign conducted after the last war by organized peace groups to convince this country that war was not pleasant. The United States did not need this movement, we were already convinced. But this campaign was one of the steps which brought this country to sink our battleships in a gesture of good will to the world; such gestures did not prevent World War II, in fact they helped bring it about.

Let us remember that the real goal is not to outlaw the atomic bomb, but to outlaw war. There is an overwhelming desire for peace in America, but are we sure that in the hearts of other nations and peoples the same desire exists? There can be no half way position.

With every desire for good will to the rest of the world, let us approach our own problems with common American horse sense.

GLENN L. ALLEN, J. H. JACOBS and J. W. HUNTER
*Western Region, Nevada District, U. S. Bureau of Mines**

# ELECTRO-PROCESS

## Developed to Produce Metallic Manganese

**Pure manganese metal from low-grade domestic ores can now become an addition to our electrochemical industries, as a result of extensive pilot plant studies conducted by the U. S. Bureau of Mines. Such a plant to produce electrolytic manganese could fit particularly well into the southern Nevada area where raw material ore, cheap power and water are abundant. This article summarizes several years of pilot plant development work and economic feasibility studies on a proposed 40-ton per day plant in the Las Vegas area.—*Editors***

PRODUCTION of metallurgical-grade manganese materials has depended largely on high-grade imported ore containing about 50 percent manganese. It is now economically feasible to produce from low-grade domestic ores a high-purity (98.5 to 99.9 percent) manganese metal, acceptable to the steel and alloy industries, by an electrolytic process developed by the U. S. Bureau of Mines.

* Respectively, senior metallurgical engineer, Reno, Nev., senior metallurgist and metallurgist, Boulder City, Nev. Condensed from U.S. Bureau of Mines Report of Investigations 3815.

Largely financed by the government as an emergency war measure, Bureau of Mines engineers and metallurgists conducted experiments over a three-year period in a pilot plant at Boulder City, Nev. Ore from the nearby Three Kids mine was used for the experimental electrolytic process development at the plant, although other similar ores may be used. More than 3,000,000 tons of usable manganese ore is known to exist in the Three Kids deposit, consisting of 1,225,000 tons of 19 percent manganese ore which can be mined by low-cost open pit methods and 1,879,000 tons of 10.6 percent ore which can be mined by underground methods. In addition, there are 320,000 tons of stockpiled 26 percent ore available for immediate use. The entire property is owned by the government and is offered for sale to private industry.

Three years of processing this ore has shown it to be commercially suitable for treatment by the bureau's electrolytic process. Small scale production by this method was begun in 1939, and by the beginning of 1945 the plant had produced a total of over 500 short tons of high-purity manganese metal. The pilot plant now has a daily capacity of 1 ton of metal most of which is being used, in cooperation with industry, for experimental purposes.

Manganese metal has been produced electrolytically on an industrial scale since 1939 by Electro Manganese Corp. at Knoxville, Tenn. The latest reported production rate was about 135 tons monthly. The process is the same as that developed by the Bureau of Mines. Only other domestic production of electrolytic manganese is the small and intermittent output of Olympic Mines, Hoodsport, Wash.

Estimates for a proposed electrolytic manganese plant presented herein are based on results of the three-year operation of this pilot plant with 20 percent ore as raw material. In summary, it is believed that total production costs of a commercial plant can be held down to 7.5c. per lb. of manganese metal under the favorable conditions in the Las Vegas area, basing this estimate on a plant capacity of 40 tons of metal daily, involving an investment of $2,431,655 (see Table I and VI).

Electrolytic manganese pilot plant at Boulder City, Nev.

### EXTRACTION PROCESS

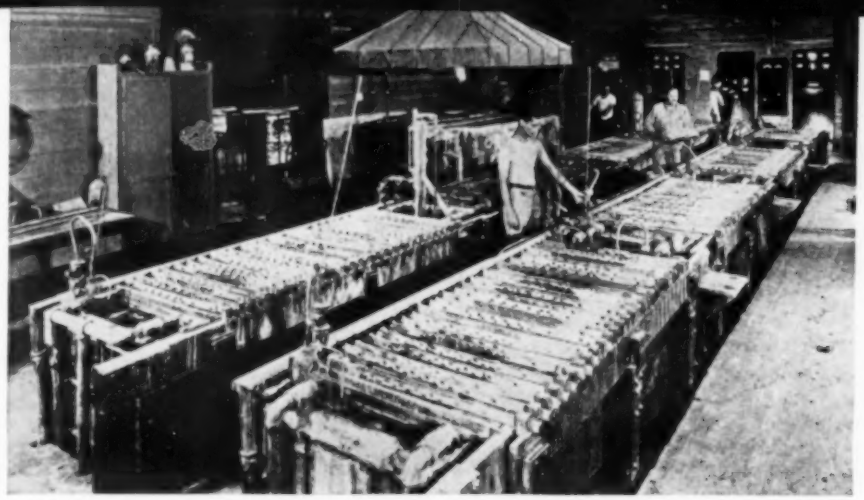
The proposed 40-ton commercial plant would contain four units: (1) crushing and grinding; (2) roasting; (3) leaching and purification; (4) electrolysis. The process to be used is shown in the attached flowsheet. Manganese dioxide ore from the mine, after passing through a feed hopper, jaw crusher and gyratory crusher, is conveyed by a belt to a weightometer which feeds a Hardinge thermal ball mill, where it is ground to minus 48-mesh. The product is collected and dried by a hot-air classifier and stored. A W. W. Sly Co. bag house collects the dust from the crusher and conveyor belts.

Ground ore is fed to an eight-hearth, 16-ft. diameter Skinner furnace containing four muffles, where the manganese dioxide is reduced at 700 to 750 deg. C. to manganous oxide to make it acid soluble. A reducing atmosphere is maintained in the furnace by dropping oil onto the seventh hearth. The reduced ore or calcine is dropped into a 7 x 20-ft. Baker cooler revolving in water, where it is cooled below 50 deg. C. before

**Table I—General Summary of Production Cost for Electrolytic Manganese[1]**

| | Dollars per Ton Ore Treated | Cents per Lb. Mn Produced |
|---|---|---|
| Raw material[2] | 0.8074 | 0.2323 |
| Electrolytic reduction | 23.7204 | 6.8237 |
| Total operating costs | 24.5278 | 7.0560 |
| Mine equipment depreciation[3] | 0.2317 | 0.0682 |
| Amortization of plant[4] | 1.3027 | 0.3747 |
| Total capital return, equipment and plant | 1.5344 | 0.4429 |
| Total production cost[5] | 26.0622 | 7.4989 |

[1] On basis of 7,000 tons of ore feed monthly; 40 tons manganese product per day. [2] Mining (no stripping or development), stock piling, reclaiming and delivery to plant. [3] $121,640 minus 20 percent resale; 5-yr. life. [4] Amortization of electrolytic plant on basis of $2,431,600 cost minus 10 percent scrap value over 20 years. [5] Including depreciation and amortization of plants but excluding property taxes, mine depletion, royalties, interest and cost of sales.



**Cell room showing lead lined wooden cells used in the pilot plant**

being exposed to the atmosphere. This is necessary to prevent oxidation. The calcine is conveyed to a 50-ton storage bin by an inclosed Redler conveyor.

Calcine is leached in 12,000-gal. batches with spent electrolyte from the cells containing 13 g. of Mn, 130-135 g. of ammonium sulphate, and 39-40 g. of sulphuric acid per liter. Brick-lined tanks, 16 x 10 ft., containing turbine agitators are used for leaching. Make-up sulphuric acid is added to the leaches as needed. Calcine is added to the leach until a pH of 2.5 is reached; the leach is then neutralized to 6.5 pH with ammonia gas, resulting in a 95-96 percent extraction.

After the leach is completed it is pumped to an 85-ft. thickener. The spigot from the thickener goes to a series of five countercurrent washing thickeners, which wash the leach residue free of manganese and ammonium sulphates. It is then pumped to the tailing pond. Overflow from the primary thickener contains metallic impurities such as As, Mo, Ni and Cu which must be removed before the solution can be electrolyzed. The overflow passes by gravity into a Turbo-absorber tank, where hydrogen sulphide is added. Metallic impurities are precipitated as sulphides and removed by filteration on an acidproof Shriver press. The filtrate is stored in a lead-lined tank.

The solution, after purification with hydrogen sulphide, is essentially free of metallic impurities but contains colloidal sulphur and colloidal metallic sulphides which are removed by the addition of ferrous sulphate solution, followed by oxidation and precipitation of ferric hydroxide. This precipitate absorbs the colloidal material and also removes any arsenic or molybdenum still present. Oxidation of iron is carried out continuously in a series of three Turbo-absorbers. After iron precipitation, the solution is allowed to age in a tank several hours before filtration on a stainless-teel filter press. The filtrate is now free of all materials harmful to electrolysis and is stored in a lead-lined tank and drawn into the cell room as needed. The purified solution contains 35 g. of manganese and 130-135 g. of ammonium sulphate per liter. Detailed cost estimates are given in Table II.

**Table II—Detailed Estimates on Leaching and Purification Costs[1]**

| | Cost per Lb. Mn, Cents |
|---|---|
| Labor and supervision | 0.3629 |
| Supplies | |
| Filter cloth | 0.0125 |
| Filter aid...720 lb. per day @$56.00 ton | 0.0252 |
| $(NH_4)_2SO_4$..0.2 lb. per lb. Mn @ $47.20 ton | 0.4720 |
| $H_2SO_4$.....0.4 lb. per lb. Mn @$4.50 ton | 0.2900 |
| $H_2S$.....0.00455 lb. per lb. Mn @$0.032 lb | 0.1450 |
| $FeSO_4$.....0.0325 lb. per lb. Mn @$55.90 ton | 0.0908 |
| $NH_3$.....5,460 lb. per day @$0.06 lb | 0.4095 |
| Oil, grease, etc | 0.0187 |
| Water, 200,000 gal. per day | 0.0130 |
| Replacement parts | 0.0750 |
| Misc. supplies | 0.0250 |
| Activated carbon.....50 lb. per day @$0.10 lb | 0.0062 |
| Total cost supplies | 1.5829 |
| Power | |
| 10,368 kwh per day @0.3¢ kwh | 0.0389 |
| Total direct cost | 1.9847 |
| Overhead | 0.0319 |
| Total leaching and purification | 2.0167 |

[1] On the basis of 40 tons of manganese daily.

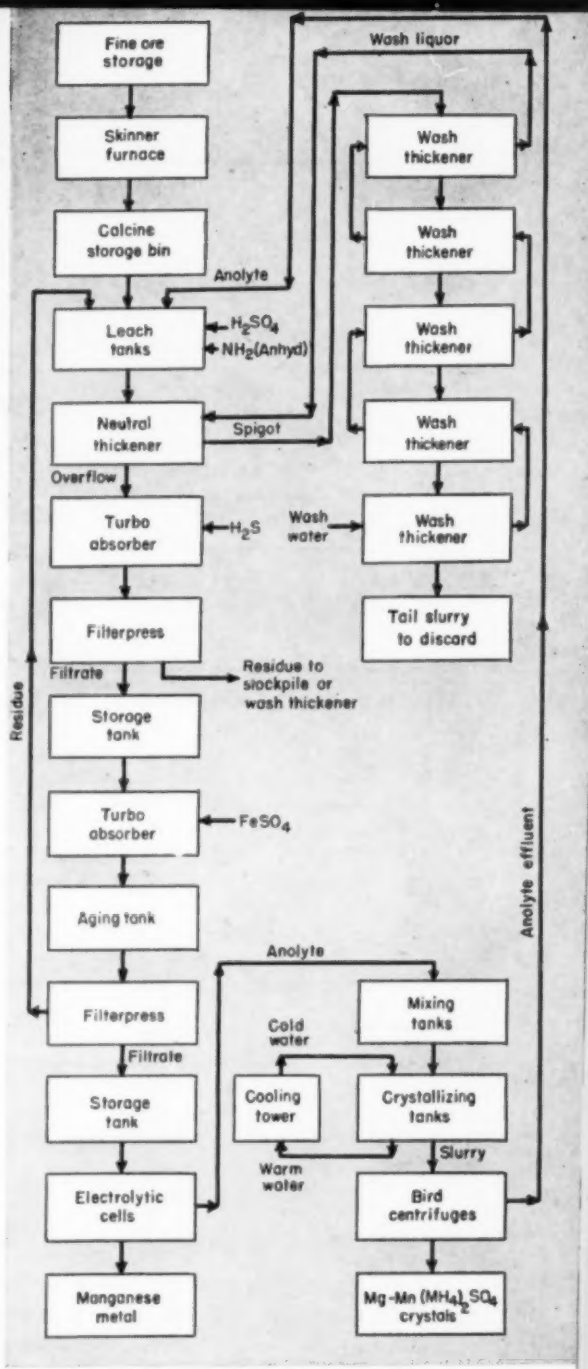
## CELL ROOM OPERATIONS

The cell room in the proposed 40-ton plant contains 264 lead-lined wooden cells. Each has a capacity of 22 anodes and 21 cathodes. The anodes are lead, containing 1 percent silver and 0.5 percent arsenic; they are perforated so as to be 40 percent void. The cathodes are type 316 stainless steel. A copper conductor bar is riveted and brazed along the top of the cathode. Each cell contains a false bottom, which serves as a reservoir for the manganese oxides that form at the anode and spall off periodically. A canvas diaphragm-covered frame surrounds the anode. A diaphragm cell is necessary to prevent the acid at the anode from mixing with the solution surrounding the cathodes, which has a pH of 8.2-8.4. The manganese concentration of the catholyte is 13 g. per l.; the feed solution is 35 g. per l., making the manganese strip 22 g. per l. Sulphur dioxide is added to the feed solution as it flows into the cell room. A cathode current density of 45 amp. is maintained; minimum current efficiency is 60 percent. The cell voltage is 5.3 v. Details of optimum conditions are given in Table III.

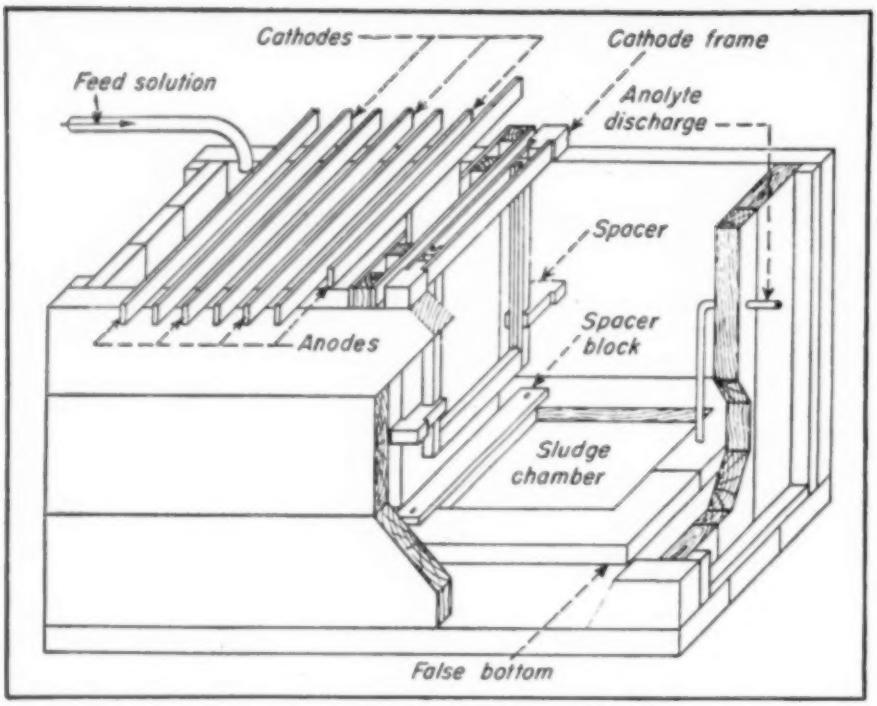
The d.c. power requirement of 13,700 kva. for the 40-ton plant is provided by four Ignitron mercury arc rectifiers, each supplying a current of 9,900 amp. at 346 v. Cells are in four independent circuits, each consisting of 66 cells in series (64 operating and 2 spares). Over-all power requirement on basis of 40 tons daily from Three Kids ore is 8,960 kwh. per ton of metal, equivalent to 4.48 kwh. a.c. per lb. Estimated usage is about 11 million kwh. a month.

Cathodes are removed from the cells individually every 24 hr. and, after dipping in bichromate solution to prevent oxidation of the manganese, the deposited manganese is washed and removed by flexing or striking with a rubber mallet. The finished product, in the form of chips just as stripped, is packed in metal containers for shipment. It contains up to 99.9 percent Mn and does not require melting or casting into pigs in order to be suitable for industrial use.

The small quantity of manganese that re-




**Flowsheet showing complete process**




**Sketch showing details of the electrolytic cell**

**Table III—Optimum Conditions for Electrolysis***

| | |
|---|---|
| Anode | 99 percent Pb, 1 percent Ag<br>10 × 38 × 1/4 in.<br>40 percent void<br>21 anodes per cell |
| Cathode | Type 316 stainless steel<br>22 × 42 × 16 gage<br>20 cathodes per cell |
| Current density | Anodes: 81–90 amp./sq. ft.<br>Cathodes: 45–50 amp./sq. ft. |
| Cell voltage | 5.3 (including 0.1-v. bus-bar drop and other losses) |
| Feed solution | Mn: 34–36 g. per l.<br>$(NH_4)_2SO_4$: 130–135 g. per l.<br>$SO_2$: 0.10 g. per l. |
| Catholyte | Mn: 11–13 g. per l.<br>$(NH_4)_2SO_4$: 160 g. per l. (calculated from $NH_3$ content) |
| Anolyte | Mn: 11–13 g. per l.<br>$(NH_4)_2SO_4$: 130–135 g. per l.<br>$H_2SO_4$: 36.8 to 43.8 g. per l. |
| Diaphragm | 18-oz. canvas |
| Duration of electrolysis | 24 hrs. |
| DC kw-hr. per lb. Mn | 3.5–3.8 |
| Cell life before cleaning | 6–8 weeks |
| Current efficiency | 60–65 percent |

* 264 cells for a 40-ton per day plant, with 8 cells being shut down for cleaning. Capacity of each cell, 312 lb. Mn per 24-hr.

**Table V—Summary Cost of Electrolytic Reduction[1]**

| Operation | Labor and Supervision | Supplies and Water | Power | Overhead | Total | Total, Cents per lb. Mn |
|---|---|---|---|---|---|---|
| Ore preparation[2] | $0.4927 | $1.5061 | $ .0921 | $ 0.434 | $2.1342 | 0.6140 |
| Leach. and purification | 1.2614 | 5.5029 | 0.1351 | 0.1110 | 7.0106 | 2.0167 |
| Electro. cell room | 2.5128 | 1.8764 | 4.3800 | 0.2211 | 8.9903 | 2.5863 |
| Pack. and shipping | 0.1043 | 1.2514 | ..... | .0092 | 1.3650 | 0.3926 |
| Total direct cost | | | | | | |
| Per ton ore | $4.3712 | $10.1369 | $4.6073 | $0.3847 | $19.5001 | ..... |
| Per lb. Mn metal | 1.2575 c. | 2.9161 c. | 1.3254 c. | 0.1106 c. | ..... | 5.6096 |
| Total direct cost[3] | | | | | | |
| Per ton ore | $2.7659 | $1.0616 | $ .0638 | $0.3290 | $4.2203 | ..... |
| Per lb. Mn metal | 0.7956 c. | 0.3045 c. | .0184 c. | 0.0947 c. | ..... | 1.2141 |
| Total operating cost | | | | | | |
| Per ton ore | $7.1371 | $11.1985 | $4.6711 | $0.7137 | $23.7204 | ..... |
| Per lb. Mn metal | 2.0531 c. | 3.2215 c. | 1.3438 c. | 0.2053 c. | ..... | 6.8237 |

[1] Costs involved in the production of 40 tons of electrolytic metal manganese per day, requiring mining of 7,000 tons of Three Kids manganese ore per month. Operating costs only. [2] Includes crushing, grinding and roasting. [3] Includes laboratories, shops, warehouse, research, office, supervision, and miscellaneous costs.

**Table IV—Detailed Estimates on Electrolytic Cell Room Costs***

| | Cost per Lb. Mn, Cents |
|---|---|
| Labor and supervision | 0.7229 |
| Supplies | |
| Water, 400,000 gal. per day @5.2 c. per M gal. | 0.0260 |
| $SO_2$ 0.00455 lb. per lb. Mn @0.085 per lb | 0.0386 |
| Canvas, 187.6 yd. @0.524 per yd. | 0.1229 |
| Anodes, (2-yr. life) 8.02 @9.00 each | 0.0902 |
| Cathodes, (3-yr. life) 5 @12.05 each | 0.0753 |
| Cathode frames (5-yr. life) 3 @ 5.80 each | 0.0218 |
| Anode frames (1-yr. life) 15 @3.00 each | 0.0562 |
| Spacer blocks (6-mo. life) 30 @0.40 each | 0.0150 |
| Misc. supplies | 0.0938 |
| Total supplies | 0.5398 |
| Power | |
| 4.2 kwh. a.c. per lb. Mn @0.3¢ per kwh | 1.2600 |
| Total direct | 2.5227 |
| Overhead | 0.0636 |
| Total, electrolytic cell room | 2.5863 |

* On the basis of 40 tons manganese daily.

**Table VI—Estimated Construction Costs of 40-Ton Electrolytic Plant***

| | |
|---|---|
| Crushing and grinding | $152,000 |
| Roasting | 71,550 |
| Leaching and purification | |
| Leaching | 36,692 |
| Thickeners | 124,192 |
| Hydrogen sulphide purification | 5,455 |
| Filtration | 96,525 |
| Iron purification | 33,950 |
| Cell starting-solution equipment | 6,275 |
| Magnesium removal | 65,879 |
| Miscellaneous equipment | 60,785 |
| Building (including roaster) | 42,200 |
| Electrolytic cell room | 731,056 |
| Other | |
| Miscellaneous buildings | 246,000 |
| Chemicals | 53,996 |
| Rectifiers | 465,000 |
| Substation | 90,000 |
| Engineer and contractor | 100,000 |
| Freight | 50,000 |
| Total | $2,431,655 |

* Based on the use of Three Kids 20 percent Mn ore. The original Bureau of Mines Report of Investigations 3815 should be consulted for detailed estimates of equipment items.

mains on the cathodes is dissolved in acid. Stripped cathodes are washed and dipped in a sodium silicate solution, followed by another wash. They are then ready to be used in the cells again. The silicate treatment leaves a very thin film on the cathode surface, which aids stripping. Every second day the cathodes are buffed before the silicate treatment to maintain a highly polished surface. This aids stripping. Temperature of the cells is maintained at 35 deg. C. by cooling coils along each side of the cell.

After a cell has operated for 6 weeks, it is shut down and cleaned and the canvas diaphragms are replaced. The manganese oxide sludge in the bottom of the cells is returned to the reducing furnace. Details of cost estimates on the cell room operation are shown in Table IV.

Spent electrolyte from the cells flows by gravity to a mixing tank in the leaching plant where make-up ammonium sulphate is added. The solution then flows to a series of four 16 x 10-ft. tanks where it is cooled to below 20 deg. C. by coils containing cold water from a spray tower. As the solution becomes chilled, a complex sulphate containing 4-5 percent manganese, 4-5 percent magnesium, 34-36 percent ammonium sulphate, and 28-30 percent water crystallizes out.

These sulphate crystals are separated from the solution in a Bird continuous centrifugal filter. Removal of the complex sulphate is necessary to keep the magnesium concentration down to the point where the complex sulphate will not crystallize anywhere else in the plant circuit. The crystals have a potential market as a fertilizer and, if sold as such, are dried in a low-temperature rotary dryer.

An over-all 88.2 percent recovery of manganese from the ore is made, with the percentage losses distributed as follows:

Crushing, 1.0; grinding, 1.98; roasting, 0.97; leaching and washing, 3.67; sulphide, purification 0.40; electrolysis, 0.88; magnesium, removal, 2.90.

Estimates of operating costs for mining (including stockpiling and reclaiming of ore from piles and delivery to plant bins) before providing for return of capital are $0.81 per ton of ore (Table I.). Estimates of electrolytic reduction cost, as summarized in Table V, would add $23.72 to bring the total to $24.53 per ton of dry ore. Since 5.7534 tons of dry ore must be treated to produce 1 ton of metal, the cost would be $141.11 per ton or 7.06 cents per lb. before allowance for return of capital. The 40-ton reduction plant is estimated to cost $2,431,665 or $60,790 per ton of daily metal-output capacity.

A summary of the costs of the various operations involved in the production of 40 tons of electrolytic manganese per day is shown in Table V. Table VI is a summary of estimated equipment and construction costs for a 40-ton electrolytic manganese plant. It is based on pilot-plant experience.

# German Pilot Plant Production of Synthetic Mica

HARRY A. CURTIS

*Dean, College of Engineering*
*University of Missouri, Columbia, Mo.*

**In August, 1945, the author took part in a preliminary survey to determine which processes and plants in the American and British controlled zones should be subjected to further detailed investigation. One of the interesting projects uncovered was the Siemens and Halske research and pilot plant production of synthetic mica under the immediate direction of Dr. Viktor Middel. This report outlines the process and highlights the critical operations.—*Editors***

RESEARCH on the production of synthetic mica had progressed well into the pilot plant stage and the second and larger of two pilot plants was then in operation. This plant was built as a final step before designing a full scale production plant and followed a smaller pilot plant which had only been successful within the preceding year.

## PROCESS DESCRIPTION

Raw materials used were technical grades of alumina, magnesia, kieselguhr and potassium fluosilicate. The proportion of these ingredients needed not be controlled very accurately. A typical mix used at the Siemens and Halske laboratory was: $Al_2O_3$, 11.6 percent; MgO, 32.6 percent; kieselguhr, 30.7 percent; $K_2SiF_6$, 25.1 percent.

These ingredients were finely ground, thoroughly mixed, and then formed into pellets about 20 mm. in diameter and 6 mm. thick. The pellets were placed in a deep crucible which was fitted with a lid having a hole in the center. As the pellets were subsequently melted, additional pellets were added until eventually a crucible full of melt was obtained. The weight of the final melt in the smaller of the pilot plants was about 10 kg. and in the larger plant about 100 kg. The crucible used was made by the Stastliche Porzellan concern of Berlin (this plant had been wrecked by bombs but the company later built a new plant near Hof, in Bavaria). Dr. Middel professed not to know the composition of the crucible, but said that he thought the alumina plus kieselguhr content accounted for at least 80 percent of the weight. He added that there was nothing in the crucible composition not also in the pellets; that not more than 10 percent of the crucible was dissolved by the melt and that this did not change the composition of the melt enough to move it out of the range in which mica is formed.

The filled crucible was then placed in a large cylindrical crucible having separate top, bottom, and cylindrical wall parts. The space between the walls of the inner and outer crucible (about 1½ in.) was packed with fused alumina sand. The purpose of this packing, according to Dr. Middel, was to support the wall of the smaller crucible which became somewhat plastic at high temperatures. The lid of the outer crucible, as well as that of the inner crucible, had a hole in the center to permit the charging of additional pellets during melting.

Dr. Middel claimed not to know the composition of the outer, three-piece, crucible, but thought that it was 80 to 90 percent silicon carbide. The crucible was made by the Koppers concern at Dusseldorf from material called "Carbomanite" which had the appearance of carborundum.

The crucible assembly was placed on a refractory stand (carborundum) which was mounted on springs, the springs serving to minimize vibration of the assembly. The crucible assembly, support, etc., were mounted over a hydraulic ram which served to raise the whole assembly vertically until the crucibles were in position in a gas-fired furnace. Before elevating the crucible assembly into the gas-fired furnace, the crucible assembly was inclosed in a vertical, electrically-heated furnace and the temperature brought up to about 900 deg. C. This preheating was only adopted to reduce the time in the gas-fired furnace.

Two gas-fired furnaces were used. The smaller furnace had six burners, entering tangentially, three at each of two levels. In the larger one there were 16 burners at four levels. Air for combustion was preheated to 500 deg. C. After the preliminary heating to 900 deg. C. the crucible assembly was raised into the gas-fired furnace and the temperature brought up to about 1,500 deg. C. As the pellets melted, more were added, until the crucible was nearly full of completely molten material. Thereafter the furnace and crucible assembly in the furnace were allowed to cool very slowly. This slow cooling, and the avoidance of vibration during the crystallization range of temperature, are the only critical features of the process, aside from materials of construction for the crucibles. In the smaller furnace the cooling from 1,500 deg. C. to 1,320 deg. C. was at a uniform rate of about 0.1 deg. per min. In the larger furnace the rate of cooling was lower, probably not over 0.03 deg. per min. if maximum size plates of mica were wanted.

After the melt in the inner crucible had completely solidified (around 1,320 deg. C.) at the center of the crucible, the temperature was lowered rapidly. When about 900 deg. C. had been reached, the crucible assembly was lowered from the gas-fired furnace into the electrically-heated furnace.

## QUALITY PRODUCT

The inner crucible had to be broken to remove the solidified mass. Some samples of solidified masses were on hand. The plates of mica making up the mass extended in all directions, some of them extending quite through the mass. Plates of mica which had been separated from the mass were available some of which were 6 to 8 in. long at the edges. The mica was clear and the cleavage was the same as that of natural mica, i. e., thin plates could be split off with a knife blade. It was said to be superior to natural mica in electrical properties as well as being far more uniform and somewhat harder.

An inquiry was made as to the cost of the synthetic mica. In the pilot plant it was estimated that the cost was perhaps ten times that of natural mica. In a full-scale unit it was thought that the cost might be reduced to about three times that of natural mica. It was also stated, by at least two of the Siemens and Halske engineers, that, in spite of the high cost of synthetic mica, the company would never again revert to using the natural material.

# ROOT STARCH

## Made in the Florida Everglades

**Sweet potato starch plant at Clewiston, Fla., of United States Sugar Corp. Grinding is done in long structure, pulverizing in small building in foreground**

**At Clewiston, in the Florida Everglades, the United States Sugar Corp.'s sweet potato starch plant, largest of its kind, began large-scale and sustained operation in February. The plant is capable of turning out 120 tons of starch per operating day, and is adaptable to the processing of roots and tubers such as arrowroot, dasheen and canna. Root starch, most of which is normally imported, became difficult to secure during the war. Construction of the Clewiston plant was authorized in 1944 to offset the loss of foreign supplies.—*Editors***

After some preliminary shakedown work the $7 million root starch plant of the United States Sugar Corp. went into full-scale production of sweet potato starch in February. Ground was broken in April, 1944. The project was undertaken at a time when the war had interrupted imports of root starch. The estimated capacity of the plant is 120 tons of finished starch per 24-hr. operating day, with a probable annual output of 50 to 75 million lb. depending on the length of the operating season. A bushel of potatoes yields between 10 and 13 lb. of starch and about 5 lb. of byproduct cattle feed.

The feasibility of the basic processes involved was established by research and development conducted since 1934 by the Bureau of Agricultural and Industrial Chemistry of the U. S. Department of Agriculture and others. During a seven-year period the sugar company's research staff had determined that in the Everglades region such crops as sweet potato, canna, dasheen, arrowroot, cassava and coontie could be satisfactorily grown and were capable of yielding starches of good quality. Department of Agriculture and company men who have been intimately connected with development of the starch project declare that the potential market for tuber and root starches and byproduct stock feed is large. Production in the United States of these starches from sweet and Irish potatoes has, in recent years, averaged about 10,000 tons annually. However, imports of starch products from Irish potato, arrowroot and cassava starches and sage flour have greatly surpassed this figure, averaging approximately 150,000 tons per year in the period 1932-1941. It is quite obvious that with the Clewiston plant in operation the capacity for domestic production of root starches has greatly increased.

This article was prepared with assistance furnished by the United States Sugar Corp. and by the Department of Agriculture including Dr. F. H. Thurber and others in the Southern Regional Research Laboratory who participated in the development work.

### DEVELOPMENT WORK

Final development work on a large scale was carried out in the starch plant of a cooperative, Sweetpotato Growers, Inc., at Laurel, Miss., with technical aid of the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry.

It is expected that more than 12,000 acres of sweet potatoes, the only crop now grown commercially for starch in that area, will be required annually by the Clewiston plant when it is in regular operation. The company plans to produce a large proportion of its requirements on its own land and also to buy potatoes from farmers in the area who may wish to grow the high-starch type of sweet potato which is utilized. The company produced several thousand acres of this variety during the 1945-1946 season. A subsidiary venture on which the company is engaged is the fattening of a herd of over 2,000 cattle on a ration containing a large fraction of the byproduct potato feed. Research is being performed at the plant laboratory under the direction of Dr. B. A. Bourne.

The potatoes are harvested with mechanical diggers, loaded into Athey wagons having specially designed clamshell type bodies and then transferred to special freight cars for removal to the factory. When the potatoes reach the plant they are dumped into a soaking pit where the adhering soil is softened. A drag conveyor 620 ft. long delivers the roots to two lines of rotary and brushing washers. Potatoes discharged from the washers are carried by an apron conveyor to a bucket elevator which lifts them to the top of the Wet Building at a nominal rate of about 25 tons per hr. This

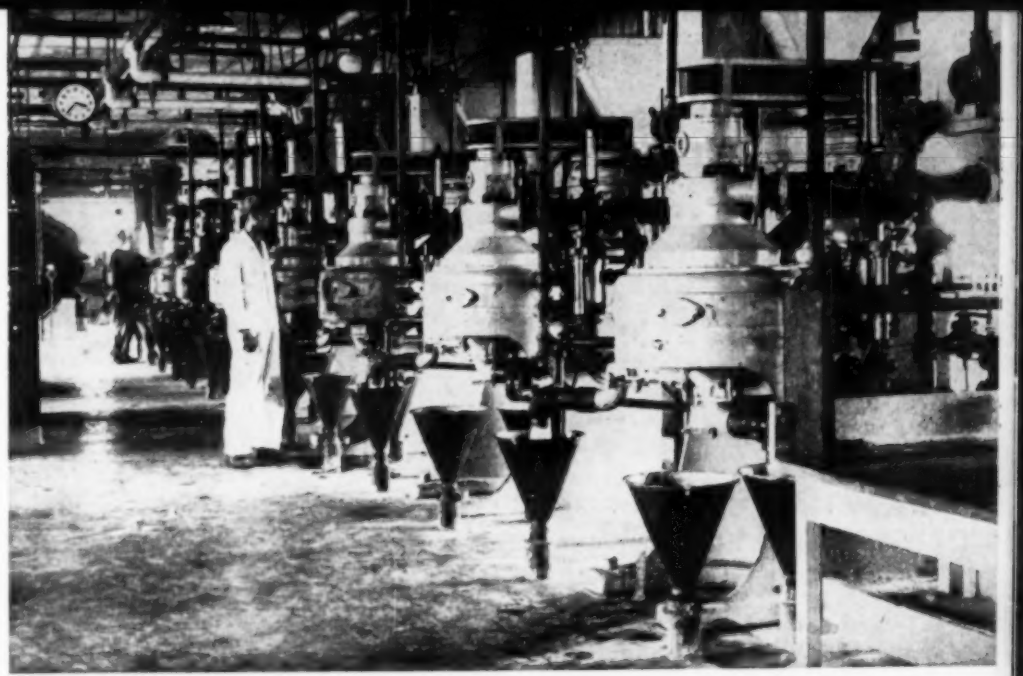
building, which contains the equipment used in grinding, extraction, refining and starch dewatering, is protected from dust by filtered air ventilation.

On entering the wet building the roots are automatically weighed on a conveyor type scale, and are then ground with process water in two stages in a system of eight Allis-Chalmers special inter-plane, or attrition, mills to free the starch granules from the cells. The sulrry of ground potatoes is passed through four Bird Machine Co. solid bowl continuous centrifugal classifiers to eliminate soluble matter. The dewatered mass discharged from these machines is slurried again with process water, chiefly return water from the succeeding screening system. The alkalinity is adjusted to about pH 10 with lime water and the liberated starch is removed by passage over Robbins Conveyors, Inc., vibrating screens. The screen overflow is again ground with return process water in the second set of attrition mills to free additional starch and is then rescreened to recover the remainder of the liberated starch. The screening is effected in a countercurrent system of four stages to minimize the amount of water required.

## REFINING

The final screen overflow passes through Davenport Machine and Foundry Co. continuous presses, and is subsequently dried as cattle feed in two 6 ft. x 50 ft. Davenport steam tube rotary dryers of two tons hourly capacity each. The starch milk underflow is pumped through refining screens to 14 Merco Starch Centrifugal Corp. continuous centrifugal thickener and refiners to remove remaining solubles and other contaminants. The refining centrifugals take the place of conventional tables and settlers. The advantage of the centrifugals is that they hasten separation and require much less space than tables and settling tanks. Three passes through the machines give sufficient refining of starch from the screening system.

The refined starch is bleached with sodium hypochlorite and when desired modified to produce the grade of product required for specific purposes. To obtain complete washing the starch is dewatered and washed on two continuous vacuum rotary filters (Oliver United Filters, Inc.).



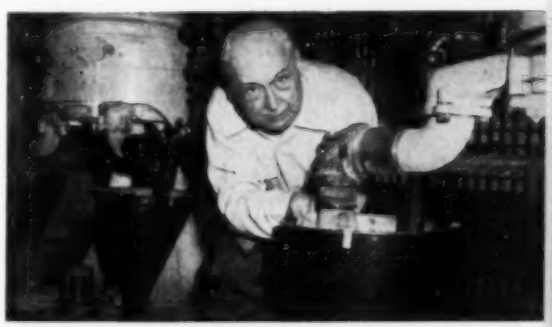
**Starch milk underflow is pumped through refinery screens to continuous centrifugal thickeners and refiners to remove remaining solubles and other contaminants**

Finally the starch is taken up in clean water and again dewatered in four Baker Perkins, Inc., Ter Meer perforate basket, automatic centrifugals. This treatment lowers the moisture content to about 35 percent. From the wet building the starch is then moved by a belt conveyor to the "drying building," where it is dried in two Hershey Mfg. Co. 7 ft. x 30 ft. steam heated rotary dryers. Ultimately the starch is pulverized in Raymond automatic, high-speed pulverizers, blended, weighed and bagged. A Fuller Kenyon system is utilized to move the starch into and out of the pulverizer building. Automatic St. Regis Paper Co. baggers, six for starch and two for feed, are used.

Large quantities of water are required in the operations. To meet the water requirements a pumping station was built five miles out in adjoining Lake Okeechobee to supply water through a 24-in. line. Water leaving the starch plant contains soluble and suspended organic matter which is removed or destroyed by sedimentation, fermentation and filtration in a waste disposal unit.

The buildings of the plant consist of reinforced concrete frame throughout. The wet building is a three-story structure with glass block curtain walls. All other buildings have glazed interior and unglazed exterior walls.

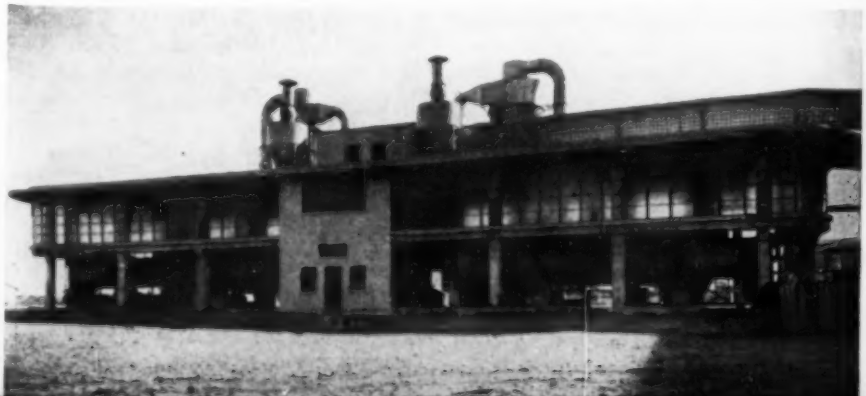
**Starch milk and byproduct cattle feed are separated from potato slurry**



**Close-up of continuous centrifugal thickeners and refiners**

**Pres. C. R. Bitting shows starch from centrifuges being conveyed to drying**

**Starch containing 35 percent moisture is conveyed on belt conveyor to drying building. Two rotary dryers handle starch and two others dry cattle feed**



LUCY O. LEWTON *Research Librarian**

# LIBRARIES

## Advance Scouts for Research

**Even though chemical engineers and chemists are probably as library-minded as any researchers, they are here reminded that the technical library is the place to start any project. While successful work is sometimes checked or verified, there is no need for duplicating the recorded failures of others.—*Editors***

For the majority of people the word "research" at once evokes visions of a laboratory with a forest of glassware and apparatus, of white coated figures watching bubbling colored liquids in complicated time-consuming tests. Few realize that the door to the world of the laboratory is almost literally through a technical library, where the library investigator, surrounded by books and steeped in tracing recorded experiences is as much engaged in research as the man at the laboratory bench. In fact, before that laboratory bench is approached, the state of prior art, the proper methods to use, and leads as to interpretation of experiments must be collected in the library. So, research usually begins in the library, continues in it and may often end in it.

Solitary investigators trying out inspired "hunches" in a cloistered laboratory are obsolete. Today, attack on a research problem is usually by a rational method of breaking it down into projects, subsequently synthesizing results, founding a superstructure of useful invention and application on much theoretical and fundamental "pure" science which has gone before—the library thus becomes the first point of attack or the front line of research.

The magnificient pooling of international research talent and knowledge in developing the atomic bomb has proved that isolationism in research is gone for all time as definitely as isolationism in politics. The scientific world was "One World" long before the politicians ever thought of the phrase. It is the printed word, the communication system of science, which has bound the research world together to cooperate as surely as aerial communications will, in time, hold the geographic world together.

### PUBLICATIONS MEASURE PROGRESS

The amount of scientific publication has been used as a measure of the technical advancement of nations and it is interesting to note that in recent years the United States has far outstripped Germany, the former leader,[1] but this volume of recorded scientific experience increases more rapidly than it can be digested or utilized. Many inventions have been foreshadowed in publications years before they saw the light; much theory, a key to unlock further riddles, has been lost; witness; Donnan theory of equilibrium of semi-permeable membranes published in an electrochemical journal, lay waiting for almost two decades before the biologist Jaques Loeb through library research uncovered and applied it as an explanation of protein behavior.

Fortunately, in recent years there have been improvements in library techniques and there has occurred an extension and great development of technical libraries as repositories, screeners and classifiers of this fund of knowledge.[2] The Special Libraries Association has 926 science technology libraries on its roster, of which 300 belong to industrial firms, while of 39 new libraries founded by private firms 27 are on scientific subjects. Institutional technical libraries such as the Science-Technology Room of the New York Public Library, the Chemist's Club Library, the Engineering Societies Library, the Academy of Medicine Library, the Paul Kollsman Library of the Institute of Aeronautical Sciences in New York, the John Crerar Library in Chicago, the Carnegie Institute of Technology Library in Pittsburgh, the Scientific Library of the Patent Office in Washington are world-famed centers to which the scientist and commercial researcher journey many miles to consult rare documents often unavailable elsewhere. A visitor to any of these will find the long tables occupied by the scientific great, easily recognized by their skillful knowledge of sources, and by the young investigators fumbling in the subject catalog. Here on the charge slips many a future Steinmetz or Edison has sketched the first dream-idea of an invention destined to revolutionize life 50 years hence.

Large centers of research such as Battelle Memorial Institute for Metallurgical Research in Columbus, Ohio,[3] and Mellon Institute in Pittsburgh maintain their own research libraries, nerve centers sending out stimuli to their investigators. Large industrial corporations carrying on research have libraries housing special collections, often of unpublished data.[4] Each of these are in charge of competent, technically trained librarians, themselves research specialists, and are staffed with technical personnel who carry on their research at a desk instead of at a laboratory bench.

### DESK RESEARCH

Desk research, like laboratory research, has its own technique and tools. When the laboratory investigator has not the time or technique to dig in the large libraries, the desk researcher must be able to know location of sources, be adroit in the use of subject catalogs and foreign periodicals and evaluate validity of the printed conclusions. A whole literature about the literature of chemistry[5] has sprung up and a text[6] has been published taking the layman behind the door marked "Librarian" in a public library. It is significant too, that just as laboratory research tools have undergone a sharpening in accuracy and refinement of efficiency, library tools also are being improved. More abstracts and reviews (the American Society for Metals Review of Metallurgical Literature is a new and welcome arrival), better methods of indexing, such as IBM and other punch card methods, the microfilm, have been recent improvements. Dr. Vannevar Bush, director, Office of Scientific Research and Development, recently indicated the library tools of the

*Patent and Data Dept., Celanese Corp. of America, 290 Ferry St., Newark, N. J.

future will be so automatic as to almost substitute an electronic device for technical librarians.[7]

But for the present, theirs is the task to summarize, condense, and catalog the vast amount of published research, making it available through intricate catalogs with suitable subject cross references, and theirs to find and bring it to the attention of the laboratory investigator.

When a laboratory research program strikes a snag, when a project bogs down because every avenue which has been explored has led to a blind alley, often a library search will reveal new vistas of untried possibilities, or enable the one correlation to be made which leads on to invention; for invention is often nothing more or less than a novel correlation or juxtaposition of already-known facts for a new and useful end. So the library can be as much the site for discovery as the laboratory—that "flash of genius" advanced by the Supreme Court can just as often strike when consulting a well-cross-referenced catalog as when making experimental observations. In fact, it sometimes is a question whether the making of that first deductive step, beyond what is observed or read, lies with the user of the catalog or is taken when the suggestive cross reference was made by technical librarian.

## ADVERTISING COPY

Success narratives of research are the usual after-dinner talk at any industrial banquet but the first stories of research library discoveries are rarely heard. Library "firsts" out of the experience of several technical librarians in various fields serve to illustrate how technical literature yielded the answer to a research problem, interpreted test results, produced a new commercially valuable product, gave a new slant to advertising a product, or extended markets.

For a number of years food columnists had been printing statements that cranberries caused acidosis. The Cranberry Growers Association brought this problem to a well-known consulting laboratory to prove or disprove. The library of the consultant worked for months running down every bit of research which had been done on the subject. Finally an error made in identifying acid content of the berries years ago was uncovered. It had been reprinted without reconsideration by others and this had been the base of an erroneous acidosis conclusion. The library recommended a re-analysis and restudy of the role of quinic acid, the characteristic acid of cranberries, with more modern methods. The results of such tests absolved cranberries from the charge of producing acidosis in the human.

It is an acknowledged fact today, that the public, more conscious of science, is getting interested in advertising with a "scientific slant." This constant demand for informative type of advertising necessitates often the presentation of a product to the consumer from an entirely new angle, stressing a hitherto unnoticed property or component. The advertisement of a certain shaving soap, graphically showing how the soap bubbles distributed themselves among the hairs of the beard, aroused much comment on its novelty and ingenuity. Yet this advertisement was based on disclosures in the technical literature of studies on the surface tension of soap solutions and how they are affected by various ingredients of the soap.

The advertising department of a well-known food company in order to be armed with ammunition for ad copy for starch pudding wished to know the origin and scientific basis for the old-time belief that arrow-root starch was more digestible than ordinary corn starch. The problem was turned over to the library of the company producing the product. These scientists uncovered a report of the original discovery of arrow-root starch by a Scottish physician visiting the West Indies in 1754. From an interesting travel diary of that period detailing empirical observations on "digestibilitie of ye arrow-root plant," the search led on to the modern microchemical analyses of different starches, proving that whereas corn starch grains had a fatty envelope, those of arrow-root were free of any envelope and therefore accessible to immediate attack by digestive enzymes.

A study of the chemical properties or constituents of a product as reported in scientific publications will often lead to newer or more advantageous uses of the product, in accordance with modern knowledge, and demands created by this knowledge. It was because oysters had been reported in the older marine zoological literature to be rich in copper and iron salts, these two minerals having been found by modern research to be effective in preventing nutritional anemia, that the South Carolina Food Research Commission was led to test the value of oysters in anemia with favorable results.

Keeping up to date with the literature will often suggest means of commercially utilizing a waste material. Investigators of pernicious anemia having published that pig and horse liver is as effective as beef liver in the treatment of this disease, a manufacturer of dog rations using horsemeat, successfully entered the field of liver extracts, while the experience of the large packing houses in supplying the medical demand for valuable gland extracts from what was formerly troublesome waste of slaughterhouses is well-known.

## LEGAL AMMUNITION

In legal battles, citations of technical literature have often been hurled at each other by the contending parties. In the famous Docket #540 before the Federal Trade Commission, in which a charge of unfair advertising was made, it develved on the defendant, who had used in his advertising the words "contains no alum, leaves no bitter taste," to actually prove that the use of alum in foodstuffs was harmful. The literature citations searched and made reference to in this case were sufficient to fill a good-sized volume in themselves, and extended as far back as 150 years. Also, starting with a purely pharmacological topic, the search soon led into the more modern domains of biochemistry, physical chemistry and even marine zoology, while the best scientific minds of the country were ranged on one side or the other, as experts to interpret this published material.

Aside from being consulted in writing labels, finding new uses for materials, interpreting laboratory results, and suggesting ideas for advertising copy, the research literature often furnishes specific information on manufacturing processes.

## LIBRARY RECONNAISSANCE

Even in mining exploration the library is sometimes a first step. The geologists picturesquely call it "library reconnaissance." Before the field geologist of a large mining company travels over terrain with pick axe and instruments, the company's staff of library geologists have already travelled over the same ground in books; and often it is they who discover published geophysical profiles indicating mineralization and so focus the field man's search to a limited area more apt to bring results of mineral discovery.

Even in construction engineering it is sometimes worthwhile to look into the past. A letter to the editor of *Life*[8] relates how the Peruvian government had for years tried in vain to find a way to bridge the Andes and make asseccible its most fertile districts. Rocky heights defied the best engineers for a railroad tunnel at too steep a gradient would have been needed. A noted engineer, remembering that early Franciscan missionaries had travelled this region, looked through one of their diaries and found an explicit description of an unnoticed short pass through—thus a solution to the problem of a trans-Andes South American highway was found in an old manuscript in a library.

An aftermath of war is the "now it can be told" era. It has been said that World War I was a chemist's war, and World War II a physicist's war. Both wars tremendously speeded up research, the results of which were fundamental to victory. Total war produced an information front as well as an economic and military front. Technological experiences of World War I were unearthed by librarians, active alike with scholars and scientists, to help win World War II.

This was a war of metals. Three librarians of metallurgical companies were called

(*Continued on page 116*)

CARSTEN F. BOE *Vice President, Atomix Inc., Wilmington, Del.*

# Simplified Methods for Calculating Stresses in PRESSURE VESSELS

**The most perplexing aspect of pressure vessel design is deciding which formula will give results that are neither too conservative nor too risky. There are two steps to making such a decision—comparing the various formulas, then picking the one which is best. However, designers are balked at the outset; the formulas are too complicated to permit comparison. So what the author has done has been to convert them to a common, comparable basis. Conservativeness is made a visible quality and the designer can pick and choose by sight.—*Editors***

DESIGNING pressure vessels invariably involves the problem of balancing safety and economy. The cost of construction materials, freight rates, weight, and ease of handling all dictate that the designer use no more material than safety requires. But when the designer attempts to calculate how much material that actually amounts to he encounters baffling complications.

In the first place, there are a considerable number of theories, or formulas, relating to the calculation of safe wall stresses (Table I) and they give different results; it is up to the designer to decide which is proper for each of the various types of pressure vessel.* However, when he attempts—as the first step in his analysis—to compare the conservativeness of one formula with that of another, he finds that they are so complicated in structure that comparison is impossible.

It is the purpose of this article to revamp the formulas and present them in such form that they can be compared, thereby providing the designer with a tangible yardstick for gaging conservativeness. Thus equipped, he can begin to draw conclusions about propriety.

To get the formulas on a consistent basis it is necessary first to set up a general equation and then make all the formulas fit that form. Actually, for reasons soon to be made clear, two general equations have been set up:

$$P/S = Y/C \qquad (1)$$

$$P/S = 2K(t/D) \qquad (2)$$

As an example of the procedure used and the utility of the results we may take the Maximum Strain formula for closed-end cylinders under internal pressure*. It is ordinarily written (for $m = 0.30$):

$$S = \frac{P(1.3\,D^2 + 0.4\,d^2)}{D^2 - d^2}$$

but can, by algebraic substitution and rearrangement, be rewritten thus:

$$P/S = Y/(1.70 - 0.4\,Y)$$

It is now in the form of Equation (1), in which $C = (1.70 - 0.4Y)$. Similarly, the formulas which express the other theories can be converted to the form of Equation (1) and they will all look alike except for the value of the $C$ term. It is now a relatively simple matter to compare formulas because the theorists' "differences of opinion" are reflected mathematically in but a single term, $C$. To compare formulas one need only compare $C$'s—observing from the structure of Equation (1) that the higher the value of $C$, the more conservative will be the resulting design. Table II gives the values of $C$ for five of the most important formulas.

The compilation of Table II is a big help (for example, it makes possible a comparison between cylinder and sphere which has interesting theoretical aspects), but for practical work it and its antecedent, Equation (1), are handicapped by the presence of the cumbersome ratio, $Y$. Therefore, we shall go back to the thorists' original formulas, take a slightly different tack, and manipulate the formulas into the form of Equation (2).

**Table I—Theories relating to calculation of wall stress in pressure vessels**

**Maximum Principal Stress:** Known also as Lamé, Rankine, or Mean Radius formulas. Considers only the tangential stress, disregarding all others.

**Maximum Strain:** Known also as Clavarino or ICC formula. Gives the "true" stress due to the maximum strain from all stresses.

**Maximum Shear Stress:** Based on an allowable shear stress equal to one half of the allowable tensile or compressive stress. Depends on the difference between the largest and smallest stress, disregarding the middle stress (which could result in an error up to 12 percent, usually on the conservative side).

**Maximum Strain Energy:** Assumes the same amount of deformation work for failure of the vessel as for a simple tension test of the material. If applied to a simple case of shear it gives a shear strength equal to 62 percent of the tensile strength, which is higher than most tests show (50 to 57 percent).

**Maximum Deformation Work:** Represents the maximum energy minus the work needed to change the volume, which in most cases is very small (ductile materials). Gives a less complicated formula and gives a shear strength equal to 57 percent of the tensile strength, which is more in accordance with tests than the other formulas when extended to the point of failure of the material.

**Thin:** This so-called "common" formula has no theoretical foundation but is often used for thin-walled vessels. Based on an even distribution of the tangential stress only. Shown in Figs. 1-4 only for comparison. Similarly:

**Maximum Thin Strain:** Based on an even distribution of the stresses, but considering the strain from all stresses.

**Barlow:** Known also as the ASME-Code formula. Assumes no change in metal volume and a stress distribution inversely related to the metal volume.

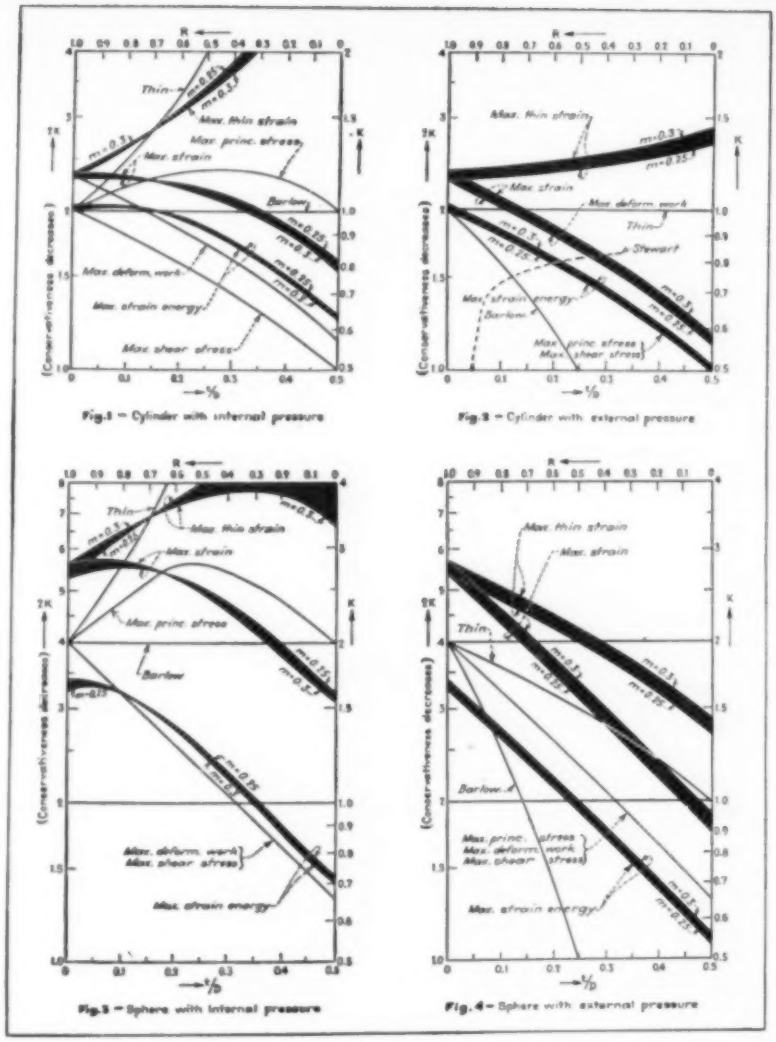
**Stewart:** An empirical formula for collapsing pressure of cylinders. Shown dotted in Fig. 2 for comparison.

* An interesting comparison of the various formulas is found in Perry's Handbook for Chemical Engineers. The comparison is made both analytically and graphically using the dimensionless ratios $P/S$ and $R = d/D$. For the sake of orientation in the subject, the reader should observe that the present analysis, as compared with that in Perry, represents a broadening of scope and extends the comparison to include: thin- as well as thick-walled vessels, spheres as well as cylinders, external as well as internal pressure.

* This is the Clavarino formula as specified in ICC regulations for stress calculations in cylinders for transport of compressed gases. Incidental to the development of this article it was found that a simplified and approximate formula,

$$E = PD/2.35t$$

can be substituted for it and incur no more than 0.1 percent error in any existing ICC specification for thin-walled vessels ($t/D$ less than 0.025). Moreover, all ICC specifications for handling gases up to 1,000 lb. pressure fall within this thin-walled field where the simplified formula conforms (± 0.1 percent) with the specified Clavarino formula.

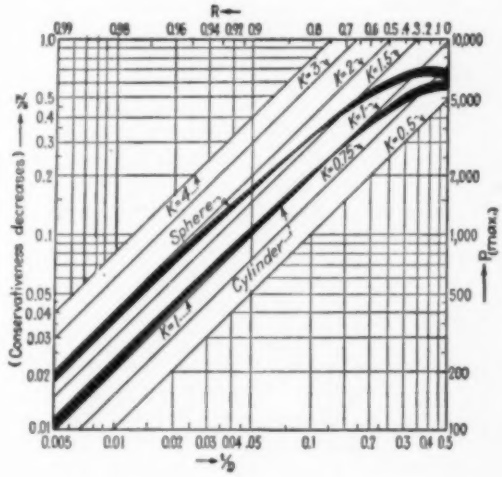



| Formula or Theory | Cylinder: $Y=1-R^2$ | | Sphere: $Y=1-R^3$ | |
|---|---|---|---|---|
| | Internal Press. | Ext. Press. | Internal Press. | Ext Press |
| Max. Princ. Stress | $2-Y$ | 2 | $1.5-Y$ | 1.5 |
| Max. Strain m = 0.25 | $1.75-0.5Y$ | 1.75 | $1.125-0.5Y$ | 1.12 |
| m = 0.30 | $1.70-0.4Y$ | 1.70 | $1.05-0.4Y$ | 1.0 |
| Max. Shear Stress | 2 | 2 | 1.5 | 1.5 |
| Max. Strain Energy m = 0.25 | $(4.0-3.0Y+1.5Y^2)^{\frac{1}{2}}$ | 2 | $(3.38-3.0Y+1.5Y^2)^{\frac{1}{2}}$ | 1.8 |
| m = 0.30 | $(3.8-2.4Y+1.2Y^2)^{\frac{1}{2}}$ | 1.95 | $(3.15-2.4Y+1.2Y^2)^{\frac{1}{2}}$ | 1.7 |
| Max. Deform Work | 1.73 | 1.73 | 1.5 | 1.5 |

**Table II, Above—Comparison of values of $C$ in equation (1) — $P/S=Y/C$ — for either spheres or closed-end cylinders under either internal or external pressure**

**Figs. 1-4, Left—Comparison of values of $K$ in Equation (2)—$P/S=2K(t/D)$—for either spheres or closed-end cylinders under either internal or external pressure**

**Fig. 5, Below—Chart for solving $P/S=2K(t/D)$. Heavy lines represent Max. Strain Energy and Max. Deform Work formulas for internal pressure. $P_{max.}$=allowable pressure for stress=10,000 lb. per sq. in. (mild steel)**




Thus, to use the same example, the Max. Strain formula will work out to be

$$\frac{P}{S}=\left(\frac{4D^2-4Dt}{1.7D^2-1.6Dt+1.6t^2}\right)\left(\frac{t}{D}\right)$$

Again the theorists' differences of opinion are resolved to a single term, 2K, and its value becomes a measure (inverse) of conservativeness—the higher the value of 2K, the less conservative the resulting design. However, because of the complexity of 2K itself, a tabulation analogous to Table II would not be very illuminating; therefore, numerical values of 2K have been computed and plotted (Figs. 1-4) as a function of $t/D$.

Thus Table II and Figs. 1-4 accomplish our purpose—they make it possible to tell by inspection how conservative or risky a given theory may be as compared to the other theories.

Fig. 5 is added here purely as a labor saving device for solving Equation (2), an operation required in practical computations. To further enhance the practicality of Fig. 5 the Max. Strain Energy and Max. Deform. Work formulas for internal pressure have been plotted there directly, making it unnecessary to consult Figs. 1-4 for K values when working with these two formulas; the difference between the two is indicated in black. (These formulas were singled out for special attention because mild steel under internal pressure appears to follow them, and mild steel is probably the most commonly used material.) The utility of Fig. 5 is of course not limited to these two formulas; it can be used for any values of K found from Figs. 1-4 or the reader can plot on it curves for any formula, analogous to the two plotted by the author.

## SYMBOLS

Units: Any Consistent System

- $C$ = Dimensionless variable defined by Equation (1)
- $D$ = Outside diameter
- $D$ = Inside diameter
- $K$ = Dimensionless variable defined by Equation (2)
- $m$ = Poisson's ratio
- $P$ = Pressure
- $R$ = $d/D$
- $S$ = Wall stress
- $t$ = Wall thickness
- $Y$ = (Metal volume)/(Total volume of vessel)

## CONCLUSIONS DRAWN

Limiting the discussion to the five formulas given in Table II (which have theoretical foundation), it is seen that there is a wide divergence between the different formulas. For instance, for very heavy-walled spheres with internal pressure, Max. Princ. Stress gives three times the values of Max. Shear Stress or Max. Deform. Work. This means that a solid ball of metal with a tiny spherical hole in the center would take a pressure of twice ($P/S=4\times0.5=2$) the tensile strength of the material, which is definitely absurd. It is therefore fairly obvious that the use of the Max. Princ. Stress and the Max. Strain formulas should be discontinued and considered unsafe for design, unless the safety factor is defined in another way based on the yield point of the material.

In the literature one often finds statements to the effect that one material follows one formula and another material follows another formula. This may be very misleading, especially if the range of wall-thickness and other conditions are not given. To understand this, it is only necessary to look at Figs. 1-4 and Table II to see how differently the curves run for different conditions. For instance, for internal pressure the Max. Princ. Stress give unsafe values, while for

external pressures it gives conservative values.

An interesting relationship between the curves for internal pressure is noted in Figs. 1 and 3; both Max. Strain and Max. Strain Energy (when compared to Max. Princ. Stress and Max. Deform. Work, respectively) undergo a reversal of values in going from the thin-walled to the heavy-walled field, the borderline being approximately $t/D = 0.1$ to 0.2. This is readily seen in Fig. 3 by comparing Max. Deform. Work with Max. Strain Energy, the difference between the two formulas being the work of changing the volume. Apparently the geometric relations at $t/D = 0.11$ is such that no work is required to change the volume. In the thin-walled field, and in the entire field for external pressure, this work required to change the volume decreases the strength of the vessel; or in other words, in the thin-walled field a soft ductile material that requires hardly any work to change the volume would be stronger than a harder, more brittle type material. This stands to reason, inasmuch as a soft material can distribute stresses throughout the wall more easily than a brittle material when the yield point is exceeded. Similarly, for values of $t/D$ larger than 0.1 the material with a high yield point would be expected to be stronger than a soft ductile material in the case of internal pressure.

Table II shows some interesting relations between the formulas when comparing cylinder and sphere in the thin-walled field ($Y = 0$): The thinner the wall thickness, the more the formulas for internal pressure approach those for external pressure. It is seen that the difference between the strength of a cylinder and sphere is very small, as little as 10 percent in the case of Max. Strain Energy. While Figs. 1-4 indicate that the sphere is twice as strong as the cylinder for the same wall thickness and diameter, this is not the case when comparing units with same total volume and metal volume ($Y$). It seems logical that a certain volume of metal should do an equal amount of work of confining a certain volume under a given pressure, as really expressed in the general formula, Equation (1). This formula can be written:

Pressure × Total volume of vessel = $S/C$ × Metal volume

For ductile materials, one would expect less difference between the values of $C$ for cylinder as compared to sphere in actual tests than would appear in Table II, due to redistribution of stresses after passing the yield point. It seems logical therefore to use $C = 1.73$ to 1.75; $S/C$ would then approximate the shear strength of the material, rendering a simple equation:

Pressure × Total volume
= Shear strength × Metal volume
or = Tensile strength × 0.57 × Metal volume (3)

For brittle and hard materials with high yield points, this relation would probably not be equally correct for spheres and cylinders, and from geometry, theory, and symmetry considerations it would be reasonable to expect the metal volume in the sphere to be more effective. Therefore, assuming Equation (3) to be suitable for all materials for the sphere, it would be reasonable to assume that less of the metal volume is active in the case of the cylinder, so that:

Pressure × Total volume
= Shear strength × $F$ × Metal volume
or = Tensile strength × G × Metal volume
or = Yield point × $H$ × Metal volume

where $F$ probably would range from 0.6 to 1.0, depending on the degree of ductility (low values for hard and brittle). Similarly G would be from 0.34 to 0.57 if the more convenient tensile strength were used. Perhaps the most accurate approach to high yield point materials would be to use the yield point as indicated above with proper values of $H$.

## LIBRARIES

(*Continued from page 113*)

in by the War Metallurgy Advisory Committee of the War Production Board to help set up a classification and index scheme for a central file of ordnance research data in Washington. Through knowledge of metallurgical literature one librarian was able to produce the cooling-time curve of steel being made into armorplate by a novel method for the metallurgist of another company. The metallurgist had searched for the S-curve himself but had not been able to find it; it gave the delicate heat-treatment adjustment necessary to eliminate brittleness and cracking in the armor steel.

On another occasion a member of the British Arms Commission sent to the United States to study American developments in carbide tools was saved three weeks work by one afternoon in a company technical library which had a complete card file on all patents and articles on this subject.

Throughout the war, the Conservation Division of the War Production Board received from several cooperating library members of the Special Libraries Association current abstracts which kept the board experts "au courant" on methods of conservation of, and substitutions for critical materials. These abstracts, forming a central master file in Washington, went as a travelling exhibit to England, while the Salvage Manual issued by the same government agency carried a bibliography at the end of each chapter compiled from data submitted by these librarian volunteers.

Chemical and pharmaceutical libraries were equally busy with war. The bewildering data on possible precursors of synthetic rubber was much clarified by the minutely detailed classification scheme for these organic chemicals for which a petroleum library has long been famous. At a pharmaceutical library requests have been filled for information on tropical disease, aviation medicine, new burn treatments and packaging problems arising from supplying medicines to troops in humid climates where little storage facilities existed.

Upon the technical libraries also fell the devising of ways and means to maintain their own sources intact as well as replenishing the resources of the bombed-out research libraries of our Allies. A Joint Committee on Importations of Foreign Material of the Special Libraries Association and American Libraries Association studied this question of keeping in contact with foreign research sources, so essential if American research is to maintain its present first position.

### DIRECTOR OF LIBRARY RESEARCH

It must not be imagined that searching the technical literature simply requires thoroughness. Quite apart from a complete knowledge of sources, foreign as well as domestic, and ability to evaluate them, this type of work demands of the searcher extensive technical training, and understanding of research concepts and viewpoints. The gift of applying the general to the specific, imagination to form the non-obvious correlation and see possibilities, ability to interpret abstract scientific ideas into terms of commercial understanding are required to carry on desk research. In fact, it takes the same mental qualities and processes of mind—analysis of problems into factors, outlining of logical steps in mode of attack, evaluation of tools and techniques to be employed—as is required by a leader or director of research.

As Lord Beaconsfield so aptly said, "The more extensive a man's knowledge of what has been done, the greater will be his power of knowing what to do."

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# Engineering Representation Is An A-Bomb "Must"

A. C. KLEIN
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**On February 13 Mr. Klein appeared before the Senate committee on atomic energy to protest against a defect in Bill S1717, the Senate bill for control of atomic energy. As these exerpts from his testimony point out, the bill provides for a five-man policy-setting commission, and under it, four operating divisions, namely, Divisions of Research, Production, Materials, Military Utilization. There is, however, no provision for administering the engineering aspects of atomic energy development—a shortcoming Mr. Klein would remedy by the inclusion of a Division of Engineering.—*Editors***

THE LEGISLATION proposed by Bill S-1717 may well be the most important post-war legislation that Congress will be called on to pass for many sessions. It creates a commisison whose powers for domestic and international good can not be overestimated. In international relations it will be a powerful arm to the President and the State Department in advancing the cause of permanent peace, and in our domestic affairs it will have a profound influence on every phase of industry through the creation of cheap sources of power. It will also have a profound effect on medical science.

The bill, in general, is an excellent measure, however it is defective in that it fails to include a division of engineering created on a parity with the other divisions designated by the Act.

By this bill the Congress will create a commission to control one of the greatest industries in the country, an industry which will rank with the steel, automotive and electric power industries. It will be well, therefore, for your committee to consider how the interrelated factors of research, engineering, production and materials are usually controlled in large industrial organizations. Not all large industrial organizations perform all of these functions. Many of them draw on outside sources for research or engineering design and construction. Much research work for industrial corporations is handled by institutions, and by research fellowships. Not all of them, handle their own engineering design and construction. Organizations are available to furnish these services. However, for those who do perform all three of these functions research, engineering and production problems are handled by separate groups, each headed by an executive especially selected for his ability in that particular field. These divisions necessarily have a different approach to the problems of the corporation and have different viewpoints which must be explored and harmonized whenever important action effecting the policies of the corporation is to be taken. We may visualize the work of the Atomic Energy Commission to be comparable to the work of such industrial corporations.

## FUNCTIONS OF DIVISIONS

As provided in the bill, there will be a division of research which should be headed by an administrative physicist of outstanding qualifications.

There should be a division of engineering, headed by an administrative engineer experienced in the fields of design and construction and having a thorough knowledge of the industrial fabric of the country and of the possibilities and limitations of production line manufacture of equipment. That is, the manufacture of equipment on a production line basis.

There will be a division of production, headed by an administrative plant operator, and this division should concern itself primarily with the operation of plants for the production of fissionable material.

The operation of these three divisions would, it seems to me, be about as follows:

The division of research would undertake a broad research program, looking toward the discovery of basic information which will simplify or improve the production of fissionable material and further its commercial, military and medical uses. It would also investigate matters requested by the divisions of engineering and production, and approved by the commission as a whole. It would make recommendations regarding changes in operating and utilization practices.

The engineering division would have an important part in passing on such recommendations from the standpoint of determining plant investment costs and operating savings (the latter in conjunction with the division of production). It would also explore and report on the ability of industry to furnish any new equipment required and would prepare time schedules of the work involved. Later, upon approval of any such project, the division of engineering would supervise the design and construction of the plants, including procurement of equipment. Close contacts among all three divisions would be maintained throughout the design and construction period and the engineering division would be responsible for coordinating such contacts.

The operations of these three divisions would always be closely related, whereas the operations of the other two divisions now provided by the bill (those of materials and military utilization) would be more self-contained and independent.

Another function in which the division of engineering would play a leading part would be in connection with the utilization of fissionable material. The most important potential use of this material is to produce cheap heat which, in turn, may be used to generate steam or to heat air or some other medium for industrial process operations, or for the generation of electric power. Of these, electric power generation is of the greatest importance.

All of these operations in the generation of heat, its use for process purposes and for the generation of electric power are fields in which the engineer is best fitted to function efficiently.

In the use of fissionable material for power generation many problems must be overcome. The services of an able director of engineering would be indispensable in

(*Continued on page 121*)

**Engineering and Construction, Research and Production Expenditures Atomic Bomb Project**

| Process | Engineering and Construction | | Research | | Production Cost per Month | |
|---|---|---|---|---|---|---|
| | Amount Millions | % | Amount Millions | % | Amount Millions | % of Construction |
| Diffusion | $500 | 91 | $45 | 9 | $6.0 | 1.2 |
| Electromagnetic | 317 | 91 | 33 | 9 | 12.0 | 3.8 |
| Metallurgical | 302 | 88 | 42 | 12 | 3.5 | 1.2 |

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# AIR DUCT DESIGN

## For Industrial Ventilating Systems

**Last month in *Chem. & Met.* Mr. Hermann discussed the factors influencing hood design for industrial ventilation systems. Equally important, however, is the design of ductwork which connects the different elements of the system. The second of this series points out the principal factors to be considered in designing air ducts for this type of service.—*Editors***

ALMOST EVERY branch of the process industries utilizes operations which cause atmospheric pollution from dust, fumes, smoke or mists. Perhaps the most important part of any exhaust or ventilating system is the ductwork through which dust or other contaminants are transferred from the source to the final disposal point. The practical application of aerodynamic theory to the design of ducts is herein discussed.

Ductwork consists of all pipes and fittings connecting the various components of a ventilating system such as hoods, dust collectors, fans, etc. It is usually fabricated sheet metal piping, rolled round or square of whatever gage thickness is suitable for the particular job. Seams and joints may be riveted and soldered, lock jointed, or welded as the nature of the work may require. Soil pipe, vitrified tile and concrete tile are also used for air ducts where acid mists are handled. Various other materials such as rubber, lead, zinc, aluminum, carbon, etc., have been used for duct construction.

Air ducts, to offer the least resistance, must be smooth on the inside surface, free of obstructions such as rivet heads, standing seams, ridges, roughness due to rust, and weld beads. The bottom of the pipe should be a continuous line although this is often sacrificed due to the higher cost of eccentric fittings. All air ducts should be air tight throughout to prevent air from leaking into or out of the system.

The proportional sizes of various components of the duct system are entirely dependent on the amount of air to be removed from the immediate area of the dust producing operations. In an earlier article (*Chem & Met.*, Feb. 1946, pp. 158-161), the mechanical aspects of hood design were discussed. Now, however some attention is given to the subject of aero dynamics which may modify hood design for the purpose of more efficient dust removal.

Observation of the action of dust particles, in their course from various dust producing operations to dispersion in the atmosphere, shows that two conditions may occur. One type of condition takes place where the movement of a dust particle is imparted to it by a machine such as a grinding wheel. The wheel having a high peripheral speed (5,500 ft. per min.), projects the dust particles at a high velocity tangentially from the surface of the wheel. This velocity is resisted by the air friction and the particle will continue to move until its kinetic energy is entirely used up by friction. Obviously, directional velocity of the dust particles is best utilized by locating the hood outlet in the direct path of this directional velocity. Since the dust stream widens out due to various influencing factors the duct connection should be flared having its larger opening adjacent to the hood and tapering to the pipe size. This feature of design results in lowered orifice losses.

### DUST PRODUCERS

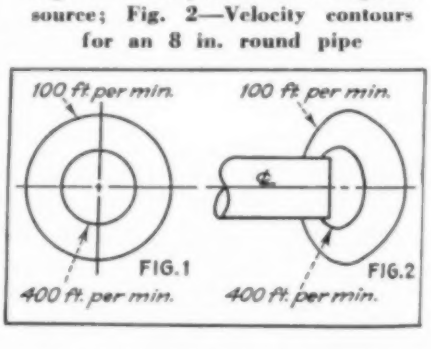
On the other hand, the dust may rise slowly from the production point such as along the course of a conveyor. This dust may move out far enough to come within the area of higher air velocities and thereby be dispersed into the general atmosphere. In other words, air currents having nothing to do with the dust producing operation may influence the dust considerably and introduce collection problems which would not otherwise exist. Studies of air currents in the vicinity of the dust producing points may bring about economies in the duct work design as well as in the power consumption of the completed system. Such air currents may often be eliminated by shielding or adjusting the hood. Not infrequently the fresh air opening into the hood can be so located as to take advange of predominating air currents.

Aerodynamic theory shows that air velocity varies inversely with the square of the distance from the source, the source, in this case, being the hood or enclosure at the dust producing point. For a point suction the velocity contours would consist of uniform and concentric circles as shown in Fig. 1. For the suction end of an 8 in. pipe the velocity contours would appear as shown in Fig. 2, that is, extending out directly in front of the opening and closing in at the circumference of the pipe. In Fig. 3 are shown the velocity contours for circular openings (ASHVE, 1932), Fig. 4 for square openings and Fig. 5 for rectangular openings.

From the data given in Figs. 3 to 5 it may be observed that to obtain high velocities outside the edge of a hood it would be necessary to remove large volumes of air at high velocities within the hood and duct work. The proper conclusion is, therefore, to use an inclosed hood wherever practical even to the extent of making basic changes in process. The inclosed hood answers all the requirements namely: (1) The dynamic projection of particles is overcome by impingement on the inner surfaces of the hood where impingement surfaces can be made sufficiently heavy to offset the abrasion; (2) cross drafts and counter currents are eliminated; (3) a minimum amount of air need be exhausted to eliminate the dust.

It is to be pointed out that the static suction prevalent in the branch pipe adjacent to the hood is no criterion as to the effectiveness of the open hood. The open

**Fig. 1—Velocity contours for a point source; Fig. 2—Velocity contours for an 8 in. round pipe**



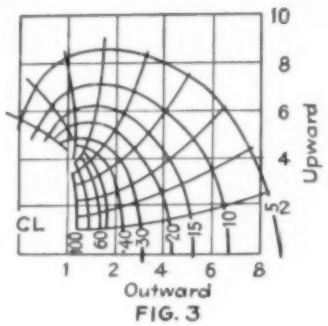



FIG. 3

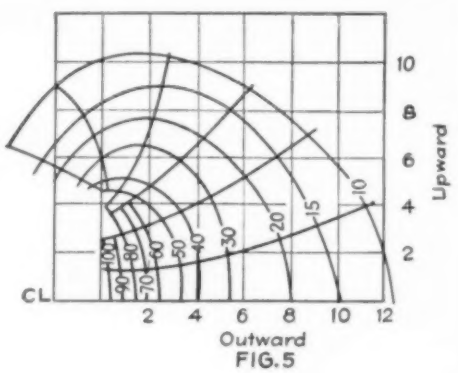



FIG. 5

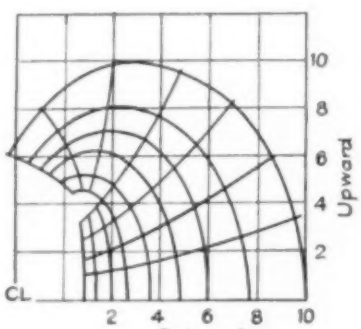



FIG. 4

**Figs. 3, 4 and 5—Velocity contours for various type of hood openings**

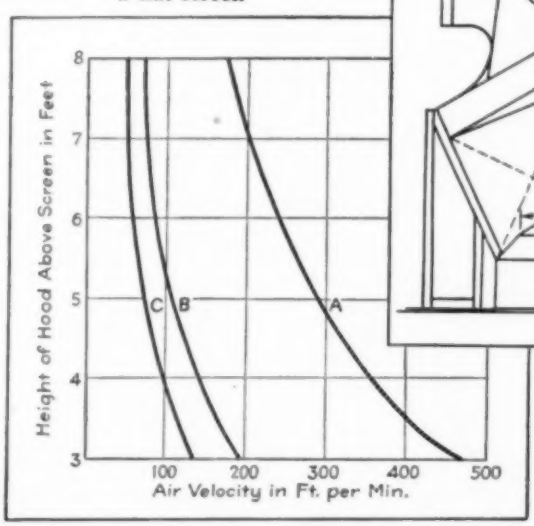
hood is a success or a failure depending on how carefully the surrounding conditions are studied. These include the source of the dust, its tendency to disperse quickly in the atmosphere, the directional velocity of the dust particles, the prevailing air currents in the area and the design velocity of the face of the hood.

By face velocity is meant the velocity of air passing through the area around and under the open hood required to prevent dispersion of the dust in the atmosphere outside the confines of the hood. In Fig. 6 is shown an open hood of the canopy type located above a vibrating screen. The hood projects over the screen to the center line. The screen is 3 ft. x 5 ft., the front edge of the hood being 4 ft. above the screen. Velocity readings were taken across the front on lines AA, BB and CC. The hood is provided with adjustable louvers so that very nearly uniform flow is obtained across the under face of the hood along line AA. Readings taken at different points along each of the lines AA, BB and CC were nearly equal for individual lines. It is noted that the drop between line AA and line BB is much greater than between line BB and line CC. The distance between line AA and line BB is 2 ft. and the distance between lines BB and CC is 2½ ft. The material being screened is hot, thus producing a temperature of approximately 150 deg. F. in the zone CC which accounts for the fact that the velocity inward at this point is considerably higher than the theoretical value. Theoretically the velocity at BB should be 90 ft. per min. instead of 140 ft. per min, and the velocity at CC should be 23 ft. per min. instead of 100 ft. per min. assuming that the velocity at AA would remain at 360 ft. per min. Thus it is seen that temperature prevailing in the immediate area of the hood affects the operation of the ventilating mechanism to a considerable extent. In this case the hood was located over the work to take advantage of the convection currents.

The manner in which the exhaust piping is connected to the hood is important in considering orifice losses. In Fig. 8 is shown three common types designated as plain connection *A*, radius connection *B* and cone connection *C*. The orifice loss for *A* is 50 percent velocity pressure, for *B*, 16 percent and for *C*, 13 percent. Obviously *C* is the most efficient one but it is also the most costly to fabricate. In most instances it is found that too much material is picked up by the air stream when using *A* and that this trouble is corrected by the use of *C*. The elements of design for connection *C* are shown in Fig. 9.

The size of pipe required at any section of an exhaust system is found by application of the basic formula: Cross section area = rate of flow (cu. ft. per min.)/velocity (ft. per min.) from which the pipe diameter can be readily determined. It is impractical to construct sheet metal pipe in fractions of an inch diameter smaller than ½ in. so that it has become standard practice to advance pipe sizes by ½-in. steps up to 30 in. diameter and thereafter by 1-in. steps. It is necessary, therefore, to design the system on the basis of a standard practice to avoid excessive costs. Sheet metal shops have standard patterns for elbows and fittings

**Fig. 6, Right—Canopy hood over a flat screen**



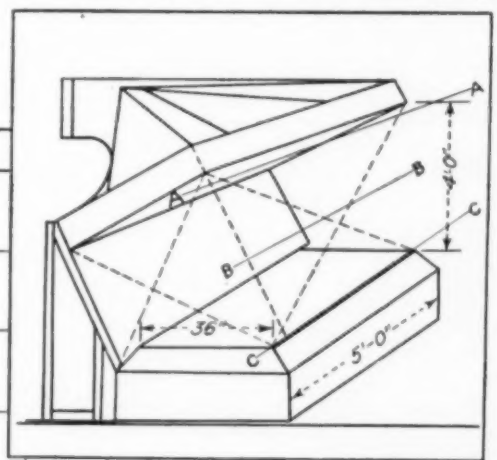




**Fig.. 7, Left—Air Velocity for different heights of hoods**

**Below, Fig. 8—Types of pipe hood connections; Fig. 9—Elements of design for C**

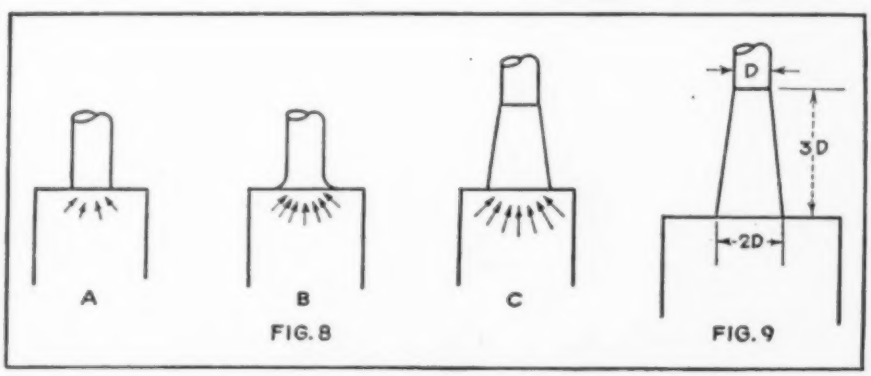



FIG. 8 FIG. 9

**Table II.—Rate of Air Flow in Various Sizes of Pipes (in Cu. Ft. per Min.) at Given Velocities and Velocity Pressures**

| Dia., In. | Area, Sq. Ft. | Velocity (in Ft. per Min.) and Velocity Pressure 3,000 0.56 | 3,500 0.76 | 3,750 0.88 | 4,000 1.00 | 4,500 1.26 | 5,000 1.56 | 5,500 1.88 |
|---|---|---|---|---|---|---|---|---|
| 2 | 0.0288 | 65 | 76 | 82 | 87 | 98 | 109 | 120 |
| 2½ | 0.0341 | 102 | 119 | 128 | 135 | 153 | 171 | 187 |
| 3 | 0.0491 | 147 | 172 | 184 | 196 | 221 | 246 | 270 |
| 3½ | 0.0668 | 200 | 234 | 250 | 267 | 301 | 334 | 367 |
| 4 | 0.0873 | 262 | 306 | 327 | 349 | 393 | 437 | 480 |
| 4½ | 0.1104 | 331 | 386 | 415 | 442 | 496 | 552 | 607 |
| 5 | 0.1364 | 409 | 477 | 512 | 546 | 614 | 682 | 750 |
| 5½ | 0.1650 | 495 | 577 | 618 | 660 | 742 | 825 | 908 |
| 6 | 0.1964 | 589 | 687 | 736 | 786 | 884 | 982 | 1,080 |
| 6½ | 0.2304 | 691 | 806 | 863 | 922 | 1,037 | 1,152 | 1,267 |
| 7 | 0.2673 | 802 | 936 | 1,002 | 1,069 | 1,203 | 1,337 | 1,470 |
| 7½ | 0.3068 | 920 | 1,074 | 1,150 | 1,227 | 1,381 | 1,534 | 1,687 |
| 8 | 0.3491 | 1,047 | 1,222 | 1,309 | 1,396 | 1,571 | 1,746 | 1,920 |
| 8½ | 0.3941 | 1,182 | 1,379 | 1,477 | 1,576 | 1,773 | 1,971 | 2,167 |
| 9 | 0.4418 | 1,325 | 1,546 | 1,652 | 1,767 | 1,988 | 2,209 | 2,430 |
| 9½ | 0.4922 | 1,477 | 1,723 | 1,846 | 1,969 | 2,215 | 2,461 | 2,708 |
| 10 | 0.5454 | 1,636 | 1,909 | 2,046 | 2,182 | 2,454 | 2,727 | 3,000 |
| 10½ | 0.6013 | 1,804 | 2,105 | 2,255 | 2,404 | 2,706 | 3,007 | 3,307 |
| 11 | 0.6600 | 1,980 | 2,310 | 2,475 | 2,640 | 2,970 | 3,300 | 3,630 |
| 11½ | 0.7213 | 2,164 | 2,525 | 2,705 | 2,885 | 3,246 | 3,607 | 3,967 |
| 12 | 0.7854 | 2,356 | 2,749 | 2,946 | 3,142 | 3,534 | 3,927 | 4,320 |
| 12½ | 0.8522 | 2,557 | 2,983 | 3,196 | 3,409 | 3,855 | 4,261 | 4,688 |
| 13 | 0.9218 | 2,765 | 3,226 | 3,507 | 3,687 | 4,148 | 4,609 | 5,070 |
| 13½ | 0.9940 | 2,982 | 3,479 | 3,728 | 3,976 | 4,473 | 4,970 | 5,467 |
| 14 | 1.0690 | 3,207 | 3,742 | 4,009 | 4,276 | 4,811 | 5,345 | 5,880 |
| 14½ | 1.1465 | 3,440 | 4,013 | 4,300 | 4,586 | 5,159 | 5,733 | 6,306 |
| 15 | 1.2272 | 3,682 | 4,295 | 4,602 | 4,909 | 5,522 | 6,136 | 6,750 |
| 15½ | 1.3104 | 3,931 | 4,586 | 4,914 | 5,242 | 5,897 | 6,552 | 7,207 |
| 16 | 1.3963 | 4,189 | 4,887 | 5,236 | 5,585 | 6,283 | 6,982 | 7,680 |
| 16½ | 1.4848 | 4,455 | 5,197 | 5,569 | 5,940 | 6,682 | 7,425 | 8,167 |
| 17 | 1.5763 | 4,729 | 5,517 | 5,911 | 6,305 | 7,093 | 7,882 | 8,670 |
| 18 | 1.7671 | 5,301 | 6,185 | 6,627 | 7,068 | 7,952 | 8,836 | 9,719 |
| 19 | 1.9690 | 5,907 | 6,892 | 7,384 | 7,876 | 8,861 | 9,845 | 10,830 |
| 20 | 2.1817 | 6,545 | 7,636 | 8,182 | 8,727 | 9,818 | 10,908 | 11,999 |
| 21 | 2.4053 | 7,216 | 8,419 | 9,020 | 9,621 | 10,824 | 12,027 | 13,229 |
| 22 | 2.6398 | 7,919 | 9,239 | 9,899 | 10,559 | 11,879 | 13,199 | 14,519 |
| 23 | 2.8852 | 8,656 | 10,098 | 10,820 | 11,541 | 12,983 | 14,426 | 15,869 |
| 24 | 3.1416 | 9,425 | 10,996 | 11,781 | 12,566 | 14,137 | 15,708 | 17,279 |
| 25 | 3.4088 | 10,226 | 11,931 | 12,783 | 13,635 | 15,340 | 17,044 | 18,748 |
| 26 | 3.6870 | 11,061 | 12,905 | 13,827 | 14,748 | 16,592 | 18,435 | 20,278 |
| 27 | 3.9761 | 11,928 | 13,916 | 14,910 | 15,904 | 17,892 | 19,880 | 21,868 |
| 28 | 4.2761 | 12,828 | 14,966 | 16,035 | 17,104 | 19,242 | 21,381 | 23,518 |
| 29 | 4.5869 | 13,761 | 16,054 | 17,151 | 18,348 | 20,641 | 22,935 | 25,228 |
| 30 | 4.9087 | 14,726 | 17,180 | 18,408 | 19,635 | 22,089 | 24,544 | 26,998 |

**Table III.—Pipe Resistance Expressed in Pipe Diameters**

| Pipe size, In. | 30-Deg. Entry | 30-Deg. Elbow | 45-Deg. Elbow | 60-Deg. Elbow | 90-Deg. Elbow | Str. Pipe |
|---|---|---|---|---|---|---|
| 3 | 8.1 | 3.4 | 5.2 | 7.8 | 10.4 | 45.0 |
| 3½ | 8.3 | 3.5 | 5.35 | 8.0 | 10.6 | 46.4 |
| 4 | 8.5 | 3.6 | 5.5 | 8.2 | 10.9 | 47.7 |
| 4½ | 8.7 | 3.68 | 5.6 | 8.4 | 11.2 | 49.0 |
| 5 | 8.9 | 3.75 | 5.7 | 8.6 | 11.3 | 50.0 |
| 5½ | 9.1 | 3.81 | 5.8 | 8.75 | 11.7 | 51.1 |
| 6 | 9.25 | 3.9 | 5.91 | 8.95 | 11.9 | 52.0 |
| 6½ | 9.4 | 3.97 | 6.05 | 9.1 | 12.15 | 53.0 |
| 7 | 9.6 | 4.02 | 6.15 | 9.25 | 12.35 | 53.8 |
| 7½ | 9.75 | 4.1 | 6.24 | 9.4 | 12.55 | 54.7 |
| 8 | 9.9 | 4.16 | 6.31 | 9.6 | 12.75 | 55.5 |
| 8½ | 10.05 | 4.21 | 6.42 | 9.7 | 12.9 | 56.2 |
| 9 | 10.2 | 4.29 | 6.5 | 9.9 | 13.1 | 57.0 |
| 9½ | 10.3 | 4.32 | 6.6 | 10.0 | 13.25 | 57.7 |
| 10 | 10.45 | 4.38 | 6.68 | 10.1 | 13.4 | 58.4 |
| 10½ | 10.55 | 4.41 | 6.75 | 10.25 | 13.53 | 59.0 |
| 11 | 10.7 | 4.49 | 6.8 | 10.46 | 13.7 | 59.6 |
| 11½ | 10.8 | 4.51 | 6.9 | 10.48 | 13.85 | 60.2 |
| 12 | 10.9 | 4.57 | 6.96 | 10.55 | 14 | 60.8 |
| 12½ | 11 | 4.60 | 7.04 | 10.6 | 14.15 | 61.4 |
| 13 | 11.1 | 4.65 | 7.1 | 10.75 | 14.25 | 61.9 |
| 13½ | 11.2 | 4.7 | 7.18 | 10.95 | 14.38 | 62.4 |
| 14 | 11.3 | 4.72 | 7.21 | 10.99 | 14.5 | 62.9 |
| 14½ | 11.38 | 4.78 | 7.3 | 11.05 | 14.65 | 63.4 |
| 15 | 11.45 | 4.8 | 7.35 | 11.15 | 14.72 | 63.9 |
| 15½ | 11.53 | 4.85 | 7.4 | 11.2 | 14.83 | 64.3 |
| 16 | 11.6 | 4.9 | 7.45 | 11.3 | 14.92 | 64.8 |
| 16½ | 11.7 | 4.93 | 7.5 | 11.38 | 15.05 | 65.2 |
| 17 | 11.79 | 4.96 | 7.55 | 11.45 | 15.15 | 65.6 |
| 18 | 11.92 | 5.01 | 7.6 | 11.59 | 15.3 | 66.4 |
| 19 | 12.00 | 5.08 | 7.7 | 11.7 | 15.5 | 67.2 |
| 20 | 12.2 | 5.1 | 7.8 | 11.84 | 15.84 | 67.9 |
| 21 | 12.29 | 5.12 | 7.84 | 11.9 | 15.75 | 68.2 |
| 22 | 12.45 | 5.2 | 7.92 | 12.00 | 15.94 | 69 |
| 23 | 12.55 | 5.24 | 8 | 12.18 | 16.1 | 69.5 |
| 24 | 12.64 | 5.28 | 8.05 | 12.25 | 16.19 | 70 |
| 25 | 12.71 | 5.31 | 8.11 | 12.35 | 16.28 | 70.4 |
| 26 | 12.78 | 5.35 | 8.18 | 12.4 | 16.38 | 70.8 |
| 27 | 12.82 | 5.41 | 8.22 | 12.46 | 16.45 | 71.2 |
| 28 | 12.87 | 5.46 | 8.28 | 12.5 | 16.5 | 71.5 |
| 29 | 12.91 | 5.5 | 8.31 | 12.51 | 16.55 | 71.8 |
| 30 | 12.93 | 5.55 | 8.33 | 12.53 | 16.58 | 72 |

**Table I.—Recommended Air Velocities for Various Materials**

| Dust | Velocity in Ft. Per Min. Branch Pipe | Main Pipe |
|---|---|---|
| Silica | 3,750 | 3,500 |
| Grinder | 5,000 | 4,500 |
| Cement | 3,750 | 3,500 |
| Limestone | 3,750 | 3,500 |
| Clay | 3,500 | 3,000 |
| Soapstone | 3,750 | 3,500 |
| Starch | 3,250 | 3,000 |
| Carbon black | 3,250 | 3,000 |
| Chemical dust dry | 4,000 | 3,750 |
| Chemical dust, hygroscopic. | 4,500 | 4,000 |
| Grain dust | 3,250 | 3,000 |
| Lint dust | 2,750 | 2,500 |
| Sugar dust | 4,000 | 3,750 |
| Tobacco dust | 4,000 | 3,750 |
| Zinc oxide | 3,750 | 3,500 |
| Lead oxide | 3,750 | 3,500 |
| Wood dust | 3,500 | 3,000 |
| Fine coal | 4,000 | 3,750 |
| Jute | 3,500 | 3,000 |
| Rubber | 3,500 | 3,000 |

of standard sizes and to order an off size pipe means that a new set of patterns must be made up involving added layout expense. For the same reason it is impractical to design for regulated air flow by means of adjusted resistance.

## DON'T USE DAMPERS

There is often a tendency to make allowance for future expansion in the system and design for elimination of portions of the system when certain machines are not in use. This is sometimes accomplished by use of dampers but any such expedient is considered bad practice. To close off any portion of the expected air flow means lowering the velocity in the remainder of the duct system with consequent settling of material along the bottom of the pipe. The build-up is surprisingly rapid and comprises a severe hazard in the case of heavy material which might break the supports allowing the pipes to fall. This problem of materials precipitating out of the air stream will be more readily appreciated by examining the velocity requirements to suspend various materials in an air stream.

The air velocity required to transport dust is a matter of considerable controversy. Some claim that the carrying velocity should be 30 percent over the terminal settling rate for a given class of material. This is far too low and should be multiplied by about seven. In fact, experience with many systems shows that a carrying velocity of from 2 to 2½ times the terminal settling velocity is more nearly correct. Table I lists the recommeded air velocity for a number of materials.

A drop of 25 percent in velocity might be permissible in some of the systems handling a specific material but it is advisable to maintain almost a constant velocity by eliminating all dampers or if dampers are necessary, welding them in place after the system has once been properly balanced. Periodic inspection of the exhaust fan and drive is desirable. All sections of pipe 10 ft. in length or over should be provided with an inspection door or slide every 10 ft. and an inspection plate should be located im-

**Table IV.—Summary of Calculations Determining the Pressure Loss in a System**

| Item in Fig. 10 | | Ft. per Min. | Dia. | Length | Equiv. Pipe Dia. | Calc. | Percent Vel. Press. | Vel. Press. | Total Press. |
|---|---|---|---|---|---|---|---|---|---|
| a | hood | 3750 | | | | | | .88 | .88 |
| | hood | | Orifice Loss | | | | 13 | .88 | .11 |
| b | 90 ell | 3750 | 5" | | 11.5 | | | | |
| c | pipe | | 5" | 5' | 12 | | | | |
| d | 90 ell | | 5" | | 11.5 | | | | |
| e | pipe | | 5" | 3' | 7.2 | 81.8 | 164 | .88 | 1.44 |
| | | | | | | 50 | | | |
| f | 90 ell | | 5" | | 11.5 | | | | |
| g | pipe | | 5" | 8' | 19.2 | | | | |
| h | entry | | 5" | | 8.9 | | | | |
| i | pipe | 3500 | 7½ | 8' | 13 | 21.9 | 40 | .76 | .30 |
| j | entry | | 5" | | 8.9 | 54.7 | | | |
| k | pipe | 3500 | 9" | 4' | 5.3 | 28.6 | 50 | .76 | .38 |
| l | 90 ell | | 9" | | 13.1 | 57 | | | |
| m | entry | | 9" | | 10.2 | | | | |
| n | pipe | | 12½" | 8' | 8 | 8.61.4 | 13 | .76 | .10 |
| o | collector | | | | | | | | 3.00 |
| p | pipe | | 13½" | 3' | 2.7 | | | | |
| q | pipe | | 13½" | 10" | 9 | 18.9 | | | |
| r | 90 ell | 3000 | 13½" | | 7.2 | 62.4 | 30 | .56 | .17 |
| | | | | | | | Total pressure loss | | 6.38 |

mediately following each elbow or transition piece in the system. The duct should be inspected periodically to see that no build-up of settled material has taken place.

Before leaving the discussion on the physical properties of duct work some mention should be made regarding materials of construction for resistance to chemicals. Exxtensive data on this subject is given in "Materials of Construction for Chemical Engineering Equipment" *Chem. & Met.*, Sept. 1944.

## PRESSURE LOSSES

The pressure losses of an exhaust system comprise: (1) Entrance loss in the hoods; (2) velocity head; (3) resistance of branch pipe including elbows, transition piece, and junction piece; (4) resistance of the main, including pipe, elbows, entries, etc.; (5) resistance of the air cleaning or dust collector equipment; (6) resistance of pipe and fittings between collector and exhaust fan; (7) resistance of the discharge pipe on fan including weather cap, wind effect, etc. The system should be credited with any drop in velocity pressure from inlet to discharge.

Selection of the proper size of pipe and fittings may be aided by use of Table II and III. Table II gives the air volume capacity of standard size duct for different air velocities. The velocity pressure corresponding to each velocity figure is included, calculated from the formula: Velocity pressure = (velocity/4,006)$^2$. Table III gives the resistance of elbows, entries, etc., expressed in pipe diameters. The last column of Table III represents the resistance of a length of straight pipe expressed in pipe diameters equivalent to a pressure loss of 1 velocity head.

To illustrate the method of determining various design factors, the following example is given. It is to be remembered that seldom are two systems of ductwork exactly alike therefore it is not likely that the example given will fit any other set of conditions. The same procedure set forth here can be used in calculating almost any system of ductwork.

The sample system is shown in sufficient detail for the purpose in Fig. 10. The system consists of six hoods placed over dust producing operations, each hood requiring approximately 500 cu. ft. per min. of air for ventilating purposes. The air velocity in the branches is to be 3,750 ft. per min. and in the main, 3,500 ft. per min. The discharge velocity from the fan is to be 3,000 ft. per min. and the discharge point is above the roof with an elbow weather cap.

In designing the system it is necessary to determine the total pressure drop, due to friction or air resistance, so that the proper fan equipment may be selected. As shown in Table IV, the various elements are listed and grouped according to pipe size. The air resistance for the various elements, in terms of equivalent pipe diameters, is taken from Table III (for straight pipes this is calculated directly) and the percentage velocity pressure loss is determined using as a base the resistance of straight pipe equivalent to a pressure drop of 1 velocity head. As shown in the table the total pressure loss sums up to 6.40 in. of $H_2O$.

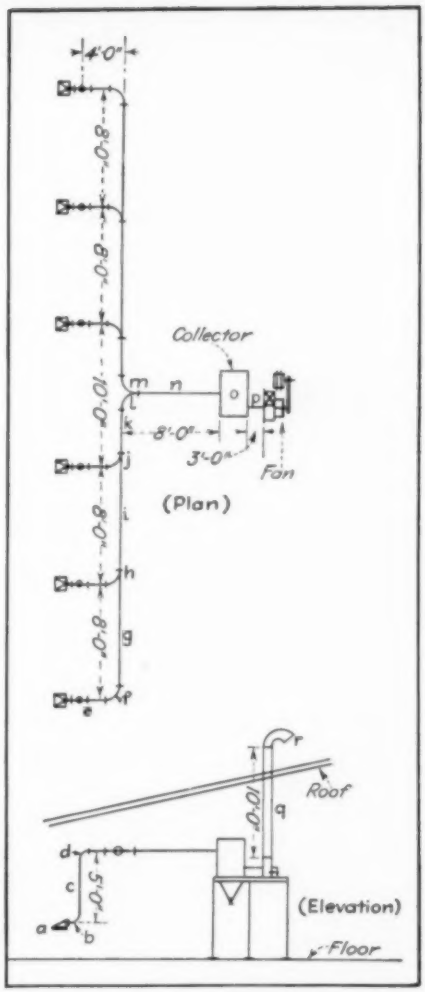



**Fig. 10—Typical ventilating system**

Brake horsepower requirements may be calculated by use of the formula $62.3pQ/12 \times 3{,}000$, where $p$ = in. $H_2O$ pressure loss and $Q$ = cu. ft. per min. Assuming a fan efficiency of 60 percent this becomes $62.3 \times 6.38 \times 2{,}982/13 \times 33{,}000 \times 0.60 = 5.02$. The system therefore requires a fan capable of handling 2,982 cu. ft. per min. of air against a total pressure of 6.40 in. $H_2O$ operated by a 5 hp. motor.

## ENGINEERING REPRESENTATION

(*Continued from page 117*)

connection with this major development of atomic power utilization.

It is particularly important that a strong division of engineering be created from the moment that the commission begins to function. The extent to which we maintain our present lead in the development of atomic energy will depend upon the skill and speed with which we implement our research discoveries by parallel engineering advancement and by the design and construction of new production plants.

In passing on these suggestions, it may be well for your committee to consider the relative magnitude of the work carried on in the fields of research, engineering and production during the development of the atomic bomb. These may be visualized by an analysis of the expenditures made by each. In the attached table they have been arranged to indicate how much money was spent on each of the processes for research, for engineering and for construction and how much is currently being spent for production.

# Chart and Tables for Vapor Pressures Of Organics Above 1 Atm.

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In a recent issue (*Chem. & Met.*, January 1946, p. 130) the author presented two charts and several tables dealing with the vapor pressures (above 1 atm.) and the corresponding boiling temperatures of 48 elements and inorganic compounds. The present article similarly treats 76 organic compounds. Not all of them have been plotted on the adjoining chart, however, since many of the lines would thus be so crowded as to be useless. To enable the user to plot additional curves, should he desire, Table I lists vapor pressures and corresponding temperatures for the terminal conditions of all compounds in the table.

**Table II—Organic Compounds Boiling in Various Temperature Intervals at 1 Atm. Pressure**

| Boiling Point Interval, Deg. C. | Substance Number (See Table I) |
|---|---|
| −169.9 to −160 | 1 |
| −109.9 to −100 | 3 |
| −89.9 to −80 | 2, 4 |
| −79.9 to −70 | 25 |
| −49.9 to −40 | 6, 5 |
| −29.9 to −20 | 28, 26, 41, 66 |
| −19.9 to −10 | 29, 8 |
| −9.9 to 0 | 68, 7 |
| 0 to 9.9 | 27, 69, 49, 74, 23 |
| 10 to 19.9 | 31, 70 |
| 20 to 29.9 | 67, 10 |
| 30 to 39.9 | 42, 57, 75, 9, 32 |
| 40 to 49.9 | 73, 33, 71 |
| 50 to 59.9 | 45, 72, 44, 46, 14 |
| 60 to 69.9 | 24, 64, 38, 13 |
| 70 to 79.9 | 22, 52, 40, 11, 53 |
| 80 to 89.9 | 51, 12, 48, 56, 34 |
| 90 to 99.9 | 76, 62, 47, 58, 16, 60 |
| 100 to 109.9 | 39, 59, 61, 18, 55 |
| 110 to 119.9 | 15, 54, 43 |
| 120 to 129.9 | 17 |
| 130 to 139.9 | 63, 30, 35, 50 |
| 150 to 159.9 | 36 |
| 180 to 189.9 | 37 |
| 210 to 219.9 | 19 |
| 250 to 259.9 | 20, 65 |
| 260 to 269.9 | 21 |

**Table III—Temperature Intervals in Which Highest Recorded Boiling Points of Various Substances Occur**

(Italics Indicate Critical Data)

| Boiling Point Interval, Deg. C. | Substance Number (See Table I) |
|---|---|
| −90 to −80 | *1* |
| 0 to 9.9 | *3* |
| 30 to 39.9 | *4*, 2 |
| 40 to 49.9 | 25 |
| 50 to 59.9 | 27 |
| 60 to 69.9 | 32, 29, 5 |
| 90 to 99.9 | 48, 56 |
| 100 to 109.9 | *6* |
| 110 to 119.9 | 39, *28* |
| 120 to 129.9 | 8, *41*, *66*, 54 |
| 130 to 139.9 | 55 |
| 140 to 149.9 | *60* |
| 150 to 159.9 | 50, 63, 7, *68* |
| 160 to 169.9 | 24, *69*, *49* |
| 180 to 189.9 | *67*, *23*, *70*, *31*, *10* |
| 190 to 199.9 | *74*, *57*, *9* |
| 210 to 219.9 | *42* |
| 220 to 229.9 | 64, *72*, *71*, *14*, *75* |
| 230 to 239.9 | *33*, *46*, *13*, *44*, *45* |
| 240 to 249.9 | 30, *38*, *40* |
| 250 to 259.9 | *58*, *53* |
| 260 to 269.9 | *47*, *51*, *16*, *62* |
| 270 to 279.9 | *60*, *76*, *59*, *18*, *55* |
| 280 to 289.9 | 20, 22, *18*, *61*, 21, *76*, *34*, 65, *11* |
| 290 to 299.9 | *17* |
| 300 to 309.9 | 19 |
| 320 to 329.9 | *18*, *43* |
| 350 to 359.9 | *35* |
| 390 to 399.9 | *36* |
| 440 to 449.9 | *37* |

* Deceased.

**Table I—Boiling Points of Organic Compounds at 1 Atm. and Various Higher Pressures**

(Data in Italics Are Critical)

| Number (See Chart) | Symbol | Substance | Boiling Point at 1 Atm., Deg. C. | Intermediate Data | | Highest Recorded Data | |
|---|---|---|---|---|---|---|---|
| | | | | Deg. C. | Atm. | Boiling Point, Deg. C. | Corresponding Vapor Pressure, Atm. |
| 1 | $CH_4$ | Methane | −161.5 | −130 | 7.5 | *−84.4* | 43.9 |
| 2 | $C_2H_2$ | Acetylene | −88.5 | −23 | 11 | 37 | 68 |
| 3 | $C_2H_4$ | Ethylene | −103.8 | −70 | 5.1 | *9.9* | 50.1 |
| 4 | $C_2H_6$ | Ethane | −88.3 | −31 | 11 | *34.8* | 50 |
| 5 | $C_3H_6$ | Propylene | −48.0 | 0 | 6.7 | 65 | 30 |
| 6 | $C_3H_8$ | Propane | −42.2 | 22 | 9 | *102* | 48.5 |
| 7 | $C_4H_{10}$ | Butane | −0.6 | 60 | 6 | *150.8* | 37.5 |
| 8 | $C_4H_{10}$ | Iso-butane | −13.3 | 30 | 4.5 | 120 | 28.5 |
| 9 | $C_5H_{12}$ | n-Pentane | 36.2 | 100 | 7 | *195* | 31.9 |
| 10 | $C_5H_{12}$ | Iso-pentane | 28 | 90 | 5.6 | *187.8* | 32.9 |
| 11 | $C_6H_6$ | Benzene | 79.6 | 150 | 5.7 | *288.5* | 47.9 |
| 12 | $C_6H_{12}$ | Cyclohexane | 81.4 | 140 | 4.4 | *281* | 40.7 |
| 13 | $C_6H_{14}$ | n-Hexane | 69.0 | 150 | 7.4 | *234.8* | 29.6 |
| 14 | $C_6H_{14}$ | di-Isopropyl | 58.1 | 100 | 3.2 | *227.4* | 31.4 |
| 15 | $C_7H_8$ | Toluene | 110.8 | 200 | 7.1 | *320.6* | 41.6 |
| 16 | $C_7H_{16}$ | n-Heptane | 98.5 | 150 | 3.7 | *266.9* | 26.8 |
| 17 | $C_8H_{18}$ | n-Octane | 125.8 | 200 | 5.8 | *296.8* | 24.7 |
| 18 | $C_8H_{18}$ | di-Isobutyl | 108.3 | 180 | 5.2 | *276.3* | 24.5 |
| 19 | $C_{10}H_8$ | Naphthalene | 218 | ... | ... | 300 | 4.76 |
| 20 | $C_{12}H_{10}$ | Diphenyl | 254.9 | ... | ... | 280 | 1.73 |
| 21 | $C_{12}H_{10}$ | Diphenyl methane | 265 | ... | ... | 283 | 1.48 |
| 22 | $CCl_4$ | Carbon tetrachloride | 76.5 | 150 | 6 | 280 | 50.3 |
| 23 | $COCl_2$ | Phosgene | 7.95 | 90 | 11 | *183* | 56 |
| 24 | $CHCl_3$ | Chloroform | 61.3 | 80 | 1.84 | 160 | 11.6 |
| 25 | $CH_3F$ | Methyl fluoride | −78.6 | 0 | 19.3 | 45 | 60.6 |
| 26 | $CH_3Cl$ | Methyl chloride | −24.2 | 50 | 11 | *143.1* | 65.8 |
| 27 | $CH_3Br$ | Methyl bromide | 3.56 | 30 | 2.5 | 50 | 4.0 |
| 28 | $CF_2Cl_2$ | Dichloro-difluoro methane | −29.8 | 40 | 9.5 | *111.5* | 39.6 |
| 29 | $C_2H_3Cl$ | Vinyl chloride | −13.6 | 5.5 | 2.1 | 60.3 | 10 |
| 30 | $C_2H_4Br_2$ | Ethylene bromide | 131.6 | 150 | 1.62 | 240 | 9.5 |
| 31 | $C_2H_5Cl$ | Ethyl chloride | 12.2 | 90 | 9.5 | *187.8* | 51.7 |
| 32 | $C_2H_5Br$ | Ethyl bromide | 38 | 50 | 1.5 | 60.0 | 1.99 |
| 33 | $C_3H_7Cl$ | n-Propyl chloride | 47.2 | 111 | 6.1 | *230.0* | 45.2 |
| 34 | $C_6H_5F$ | Benzene fluoride | 84.9 | 150 | 5.1 | *286.5* | 44.6 |
| 35 | $C_6H_5Cl$ | Benzene chloride | 132 | 200 | 4.6 | *359.2* | 44.6 |
| 36 | $C_6H_5Br$ | Benzene bromide | 156 | 250 | 6.8 | *397.0* | 44.6 |
| 37 | $C_6H_5I$ | Benzene iodide | 188.6 | 280 | 5.9 | *448* | 44.6 |
| 38 | $CH_4O$ | Methanol | 64.7 | 140 | 10.6 | *240* | 78.7 |
| 39 | $CH_2O_2$ | Formic acid | 100.7 | ... | ... | 110.6 | 1.34 |
| 40 | $C_2H_6O$ | Ethanol | 78.5 | 150 | 9.65 | *243* | 63.1 |
| 41 | $C_2H_6O$ | Dimethyl ether | −23.7 | 33.6 | 7.5 | *127.1* | 53.0 |
| 42 | $C_2H_4O_2$ | Methyl formate | 31.9 | 100 | 7.6 | *214* | 59.2 |
| 43 | $C_2H_4O_2$ | Acetic acid | 118.5 | 200 | 7.7 | *321.6* | 57.2 |
| 44 | $C_3H_6O$ | Acetone | 56.1 | 120 | 6 | *235* | 47 |
| 45 | $C_3H_6O_2$ | Ethyl formate | 54.3 | 140 | 9.7 | *235.5* | 46.7 |
| 46 | $C_3H_6O_2$ | Methyl acetate | 57.2 | 140 | 9.3 | *233.7* | 46.3 |
| 47 | $C_3H_8O$ | n-Propanol | 97.4 | 150 | 5.2 | *263.7* | 50.7 |
| 48 | $C_3H_8O$ | Iso-propanol | 82.3 | 1.12 | 85 | 90 | 1.34 |
| 49 | $C_3H_8O$ | Methyl ethyl ether | 7.5 | 70 | 7.2 | *164.7* | 43.4 |
| 50 | $C_4H_6O_3$ | Acetic anhydride | 136.5 | ... | ... | 150 | 1.54 |
| 51 | $C_4H_8O_2$ | n-Propyl formate | 81.0 | 150 | 6 | *264.9* | 40.1 |
| 52 | $C_4H_8O_2$ | Ethyl acetate | 77.2 | 170 | 10.2 | *250* | 38.1 |
| 53 | $C_4H_8O_2$ | Methyl propionate | 79.7 | 150 | 6.4 | *257.4* | 39.5 |
| 54 | $C_4H_{10}O$ | n-Butanol | 117 | ... | ... | 129 | 1.7 |
| 55 | $C_4H_{10}O$ | Iso-butanol | 108.4 | 110 | 1.1 | 130 | 2.18 |
| 56 | $C_4H_{10}O$ | Tertiary butanol | 82.8 | 85 | 1.1 | 90 | 1.31 |
| 57 | $C_4H_{10}O$ | Di-ethyl ether | 34.6 | 110 | 8 | *193.8* | 35.5 |
| 58 | $C_5H_{10}O_2$ | Secondary butyl formate | [illegible]9 | 160 | 5.2 | *278* | 38 |
| 59 | $C_5H_{10}O_2$ | Propyl acetate | 101.6 | 150 | 3.6 | *276* | 32.9 |
| 60 | $C_5H_{10}O_2$ | Ethyl propionate | 99 | 150 | 3.8 | *272.9* | 33 |
| 61 | $C_5H_{10}O_2$ | Methyl butyrate | 102.8 | 150 | 3.5 | *291.5* | 34.2 |
| 62 | $C_5H_{12}O$ | Methyl iso-butyrate | 92.3 | 150 | 4.5 | *287.6* | 33.7 |
| 63 | $C_5H_{12}O$ | Iso-amyl alcohol | 130.5 | 140 | 1.35 | 150 | 1.84 |
| 64 | $C_5H_{12}O$ | Ethyl propyl ether | 62.3 | 90 | 2.5 | 220 | 28.8 |
| 65 | $C_{12}H_{10}O$ | Diphenyl oxide | 259 | ... | ... | 288 | 2.0 |
| 66 | $C_2N_2$ | Cyanogen | −21.2 | 20 | 4.85 | *188.3* | 59.7 |
| 67 | CHN | Hydrocyanic acid | 25.6 | 65 | 3.7 | *180.4* | 47.7 |
| 68 | $CH_5N$ | Methylamine | −6.6 | 51.4 | 8 | *156.9* | 73.1 |
| 69 | $C_2H_7N$ | Dimethylamine | 7.2 | 76.6 | 9.6 | *164.6* | 52.4 |
| 70 | $C_2H_7N$ | Ethylamine | 16.6 | 110.2 | 15.3 | *183.2* | 55.4 |
| 71 | $C_3H_9N$ | Propylamine | 48.7 | 135 | 10.7 | *223.3* | 46.8 |
| 72 | $C_4H_{11}N$ | Diethylamine | 55.5 | 111 | 4.9 | *223.3* | 36.6 |
| 73 | $CS_2$ | Carbon disulphide | 46.3 | 120 | 6.9 | *273* | 75.0 |
| 74 | $CH_4S$ | Methyl sulphide | 7.6 | 80 | 9.3 | *190* | 64.9 |
| 75 | $C_2H_6S$ | Di-methyl sulphide | 35.8 | 120 | 9.1 | *229.9* | 54.6 |
| 76 | $C_4H_{10}S$ | Di-ethyl sulphide | 90.3 | 180 | 8.4 | *283.8* | 39.1 |

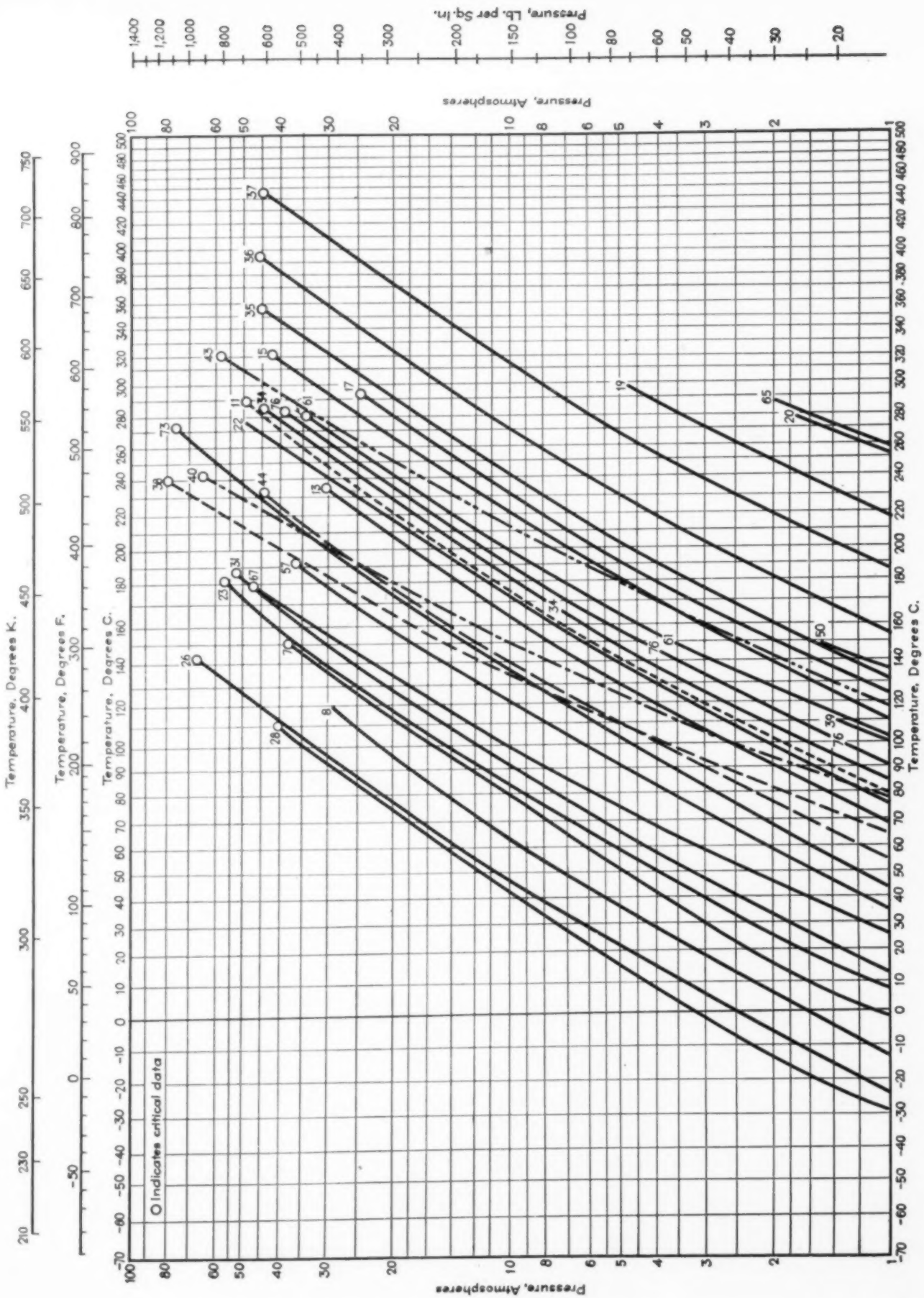

Pressure, Lb. per Sq. In.
Pressure, Atmospheres
Temperature, Degrees K.
Temperature, Degrees F.
Temperature, Degrees C.
Temperature, Degrees C.
Pressure, Atmospheres
O Indicates critical data

**Table IV—Pressure Intervals in Which Highest Recorded Boiling Points of Various Substances Occur**

(Italics Indicate Critical Data)

| Pressure Interval, Atm. | Substance Number (See Table I) |
|---|---|
| 1 to 1.99 | 56, 39, 48, 21, 50, 54, 20, 63, 32 |
| 2 to 2.99 | 65, 55 |
| 4 to 4.99 | 27, 19 |
| 9 to 9.99 | 30 |
| 10 to 19.99 | 29, 24 |
| 20 to 24.99 | *18, 17* |
| 25 to 29.99 | *16*, 8, 64, *13* |
| 30 to 34.99 | 5, *14*, 9, *10*, *59*, *60*, *62*, *61* |
| 35 to 39.99 | *57*, *72*, 7, *58*, *52*, *76*, *53*, *23* |
| 40 to 44.99 | *51*, *12*, *15*, *49*, *1*, *54*, *35*, *36*, *37* |
| 45 to 49.99 | *33*, *40*, *45*, *71*, *44*, *67*, *11*, *6* |
| 50 to 54.99 | *4*, *3*, 22, *47*, *31*, *69*, *41*, 75 |
| 55 to 59.99 | *70*, *23*, *43*, *42*, *66* |
| 60 to 69.99 | 25, *40*, *74*, *26*, 2 |
| 70 to 79.99 | *68*, *73*, *38* |

As in the January article the arrangement of compounds in Table I is according to the central atoms. Table I gives the boiling points at 1 atm., at some intermediate vapor pressure, and at the highest recorded temperature. If the latter is the critical temperature, it is printed in italics. Table II arranges the substances by boiling points at 1 atm. according to temperature intervals, while Table III arranges them similarly according to the highest recorded temperatures. The same is done, according to highest pressures, in Table IV.

## ERNST BERL—AN APPRECIATION

*You did not have to be a world-famous scientist to know and love Ernst Berl. A humble man, despite the certainty that history will number him among the most distinguished chemical engineer-chemists of our day, he found his friends among all grades and ranks in the profession, and among many nationalities. Born 68 years ago in Austrian Silesia, he was at the time of his death on February 16 a naturalized American citizen by accident of a trend in his homeland that he could only detest and abhor. By preference, we believe, he would have been a citizen of the world, for his science knew no geographical boundaries and his chief ambition was to direct his talents toward the service of mankind. What a tragedy it was for him, then, that twice within his lifetime his sense of duty forced him to contribute his great energies toward the scientific arts of war!*

*In a way it was strange how fate conspired to make him a foremost authority on explosives. Student, assistant and later collaborator of the great Lunge, under whom he developed a command of the heavy acids, he was conditioned also toward cellulose chemistry by the fact that his father had been a lumber merchant. The circumstance that his military service had been in artillery aroused his interest in explosives chemistry and a period as chief chemist of the nitro rayon plant at Tubize, Belgium, added to his authority in this field. It was only logical that the next step should have been as chief chemist, in charge of munitions production for the Austrian government during World War I. Following that was a happy and fruitful period in teaching and research at Darmstadt, but the clouds of intolerance and international distrust were gathering and in 1933 he decided to throw his lot with his many friends on this side of the water.*

*It is too soon to decide whether his remaining years as research professor at Carnegie Tech were the most productive. Although his interests turned to many things, frequently recorded in* Chem. & Met., *his most publicized achievement lay in a quick process for making oil- and coal-like materials from farm wastes, and his least publicized, in his very real services as explosives advisor to the United States government. Many men, though, will remember him chiefly as a friend with an almost extravagant regard for the humbler accomplishments of others. No, you did not have to be his scientific peer to earn his approbation. All he asked was that you did your job, in the best way of which you were capable*—EDITORS.

# Protecting Workers From the Effects of Toxic Organic Solvent Vapors

ALL VOLATILE organic solvents, including gasoline, benzene (benzol), naphtha, carbon tetrachloride, and trichlorethylene, give off toxic vapors. Hence, workers using any of these solvents in cleaning, degreasing, cementing and other operations must be protected from the effects of inhaling excessive amounts of their fumes.

According to the Safety Research Institute, New York, basic protection should be provided by keeping the concentration of solvent vapors in the general atmosphere of the workroom below "the maximum allowable concentration (M.A.C.) for continuous exposure."

This limit, which represents the maximum concentration of solvent vapor to which workers may be continuously exposed during the eight-hour work day, has been established by the American Standards Association for several of the commonly used solvents, but many states have standards of their own. The limits vary from 50 parts of solvent vapor per million parts of air for benzene to 1,000 parts per million for petroleum products unmixed with more toxic substances. Solvent users can obtain M.A.C. tables from the Industrial Hygiene departments of their respective states, or, in states without such departments, from the U. S. Public Health Service, Washington, D. C.

Natural ventilation may suffice to provide this basic protection where the contamination of the atmosphere is slight, as where the solvent is being used in small quantities or is applied in equipment that prevents the escape of vapor. In other cases, it may be necessary to employ some form of mechanical ventilation, such as a local system which will draw off the vapors as they arise or strong general ventilation which will rapidly dilute the vapors to a safe level, as advised by a ventilating engineer.

Working conditions in a plant are probably satisfactory if the air is free from the pronounced odor of the solvent being used; but, since odor is not an adequate criterion, an atmospheric survey should be made. This requires the services of a competent chemist. In some states, such work is done by the State Industrial Hygiene Department on request.

However, even where the workers as a group are effectively protected by these measures, certain individuals may be endangered by practices like the following:

1. Using solvents in poorly ventilated areas, such as small rooms, basements, pits, etc.
2. Applying solvents in close proximity to the face, as in spotting garments or cleaning floors or machinery.
3. Working over open containers of solvents.
4. Handling products damp with solvents.
5. Opening containers or equipment holding solvents in such a manner that high concentrations of the vapor are inhaled.
6. Permitting drafts to blow solvent vapors in the direction of workers.
7. Allowing persons to work with solvents to which they are abnormally sensitive.
8. Entering tanks containing solvent vapors without proper respiratory protection.

It is not enough to prohibit such practices. Workers must also be educated to the dangers involved, and constant supervision must be maintained to prevent any one from taking chances.

When workers are unavoidably subjected to excessive concentrations of solvent vapors, they should be protected with suitable gas masks. Where the vapor concentrations are relatively low, canister-type masks approved for organic vapors by the U. S. Bureau of Mines may afford adequate protection; but, for high concentrations, as in vapor-filled tanks, approved air-line respirators must be employed.

# War-Developed Oxygen Generator With Postwar Possibilities

Oxygen has been used extensively and in large quantities as raw material in coal gasification, the production of synthetic fuels, and many other chemical processes. In any process requiring the use of air, it is the oxygen in the air that is important.

On a high altitude mission, oxygen is as important as gasoline. It is as important to the men as fuel is to the engines. A bomber cannot fly eight or nine miles above the earth unless it takes along a sufficient supply of oxygen for its crew. Each man breathes 7 cu.ft. per hr. In the bomber, the oxygen is carried in flight bottles at a pressure of 400 lb. After each flight these bottles have to be refilled from cylinders loaded with oxygen at 2,200 lb. The cylinders weigh 150 lb. each.

After they have been used, they have to be returned to the source of supply for refilling. During the North African campaign, oxygen was shipped all the way from Johannesburg, South Africa. In the Pacific, where many bases are on small and isolated islands, far removed from sources of supply, the problem was even more difficult.

To help solve this problem, Clark Bros. Co., Inc., of Olean, N. Y., one of the Dresser Industries, has produced a portable oxygen unit which could be flown to advance bases. It could be broken down into individual pieces, each weighing less than 3,000 lb., and small enough to be loaded into the cargo hatch of a C-46 transport. With no special supplies other than those ordinarily found at such bases—gasoline, oil, and a little water—the Clark plant could be filling oxygen cylinders within 24 hr. after it had been landed.

Small semi-portable oxygen generating plants were available before the war. They were, however, extremely heavy and bulky. Furthermore, they required chemicals and drying agents for their operation. This complicated the problems of supply and the additional equipment added still more to their weight. At the request of the Army, the National Defense Research Committee undertook the design of a plant which would overcome these disadvantages.

Cooperation between this committee, Clark Bros. and the M. W. Kellogg Co. resulted in the development of a plant which has fulfilled the Army's requirements. The unit produces more oxygen than previous plants almost twice its weight. A low operating air pressure of 100 lb. makes it considerably safer than previous plants. Its operation is so simple that enlisted men could be trained to run it in a week's time.

In addition to the air-borne unit, Clark has produced a semi-trailer model. Weighing ten tons and under 20 ft. long, it could be hauled to any front line base a heavy army truck can reach.

The light weight of the unit was achieved by aviation type techniques of design. Throughout, light fittings and piping are used. Both the air-borne and trailer units are powered with light weight aviation engines.

This light weight plant, however, has to produce not merely oxygen but chemically pure oxygen. It must be absolutely free from invisible water vapor that would freeze and clog oxygen lines or masks at the low temperatures of high altitudes.

As oil cannot be used because of the explosion hazard, previous plants used water or soap and water as a lubricant. This necessitated the use of chemicals for drying the oxygen and with no assurance that it would be dry enough. To make absolutely certain, Clark engineers decided to design a compressor which would operate without oil—it requires no lubrication other than that supplied by segmental carbon rings on light aluminum pistons running in highly polished chromium plated cylinders. This method has been used in the past with relatively slow compressors and water lubrication, but the compressor in this unit is high speed, its pistons traveling at the rate of 1,200 ft. per min. The same principle was used in the design of the compressor which charges the oxygen cylinders.

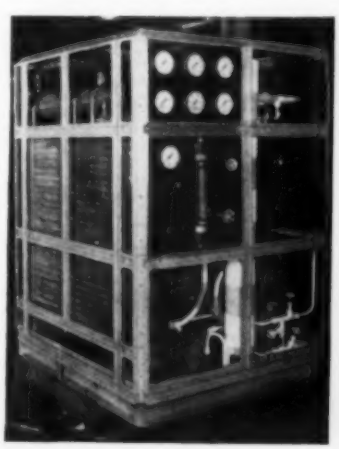
Another feature which has made this unit possible was the development of a small but highly efficient expansion engine, designed to operate on 100 lb. of air pressure. This engine, specially designed for the portable oxygen unit, has an efficiency of over 80 percent.

The heart of the unit is the 6-ft. "cold box" where oxygen is produced by liquefying ordinary air, then allowing the liquid to boil in such a way that its oxygen and nitrogen vaporize separately. Temperatures of nearly —300 deg. F. are required to liquefy the air by this process.

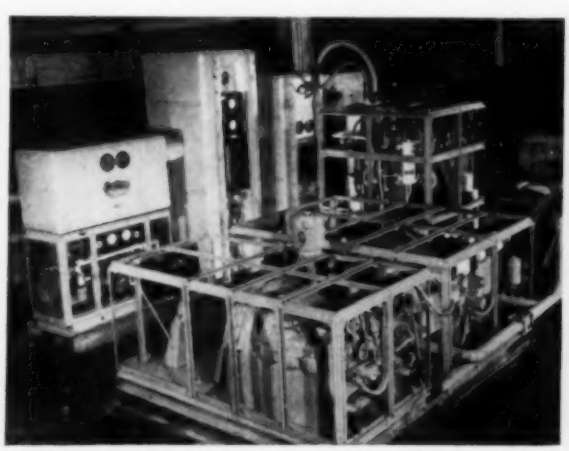
One of the devices used in cooling the air to this low temperature is a heat exchanger designed by Dr. S. C. Collins of the Massachusetts Institute of Technology. These heat exchangers, of which there are 24 in the "cold box," use a total of 11 miles of piper-thin copper ribbon, 0.15 in. wide. This construction has made it possible to keep the size of these exchangers down to 5-ft. If it were not for the use of copper ribbon, they would have had to be thirty times as large.

In its present stage, the oxygen generator was primarily used to meet an emergency. Its development, however, has already uncovered a number of postwar possibilities for which oil-free compressed air will be useful. More important now is the fact that this unit, with its simplicity of operation, its relatively low weight, and its portability, can do so much to get the greatly needed oxygen to the right place at the right time.

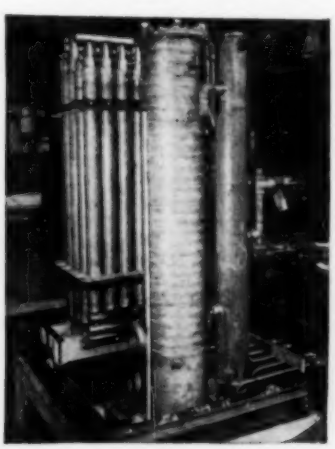
**Intake air is compressed to 100 lb. in two stages, sent to radiator after each step**



**Oxygen generating unit which can be broken down into six parts, each weighing less than 3,000 lb. and small enough to be carried by C-46 transport**



**Six-foot "cold box." Oxygen and nitrogen are vaporized separately from liquid air**



# CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

## $50 CASH PRIZE FOR A GOOD IDEA!

Commencing with entries received during April the editors of *Chem. & Met.* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the "*Chem. & Met. Plant Notebook.*" The March winner will be the last to receive a $50 E Bond. As previously, the winner each month will be announced in the issue of the next month: e.g., the April winner will be announced in May, and his article published in June. Judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest will be published if acceptable, in that case being paid for at space rates applying to this department. (Right is reserved, however, to make no award in months when no article received is of award status.)

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

### FEBRUARY WINNER!

**A $50 Series E Savings Bond will be issued in the name of**

**L. K. ARNOLD**
Engineering Experiment Station
Iowa State College
Ames, Iowa

**For an article dealing with a simple hoist and mover for use in pilot plant handling of acid carboys that has been judged the winner of our February contest.**

**This article will appear in our April issue. Watch for it!**

### January Contest Prize Winner

## HOW TO BUILD A VISIBLE DECANTER FOR PILOT PLANT USE

W. L. JACOBS and F. M. HILDEBRANDT
U. S. Industrial Chemicals, Inc.
Baltimore, Md.

IN PILOT PLANT operation, the problem of separating immiscible liquids frequently arises. This separation, easily accomplished in the laboratory by means of a separatory funnel, is not so readily made where batches of the liquids have to be handled in lots of 150 to 300 gal. in tanks. In such cases a device that allows the separation to be made precisely but with a minimum of connections to the tank is desirable. The decanter to be described here can be used on any small tank, is very simple to construct and installing it does not involve any injury to the vessel, since it is not necessary to drill the walls if the tank is provided with the usual inlet and outlet openings.

The principle of operation is to place the mixture of liquids in the tank, allow time for the layers to become established and then close the vessel and force the lower layer out through an alcohol still tail box or similar device by means of air pressure. When the lower layer has been discharged and the upper layer comes into the sight glass of the tail box, this fact is visually evident at once and the operation can be

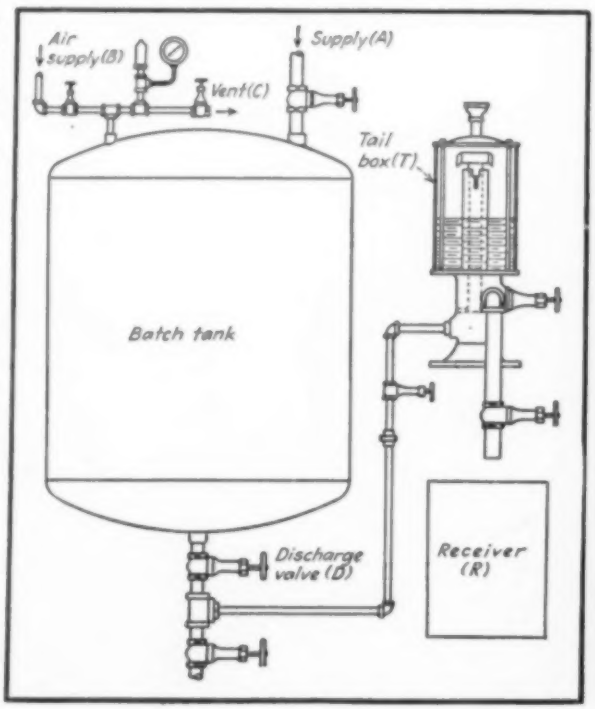



**Fig. 1—Details of decanter constructed from a glass tail box**

**Fig. 2—Here is an actual installation in a pilot plant**

interrupted long enough to permit the layers to establish themselves in the glass after which the separation can be completed very precisely. The tail box is not under pressure and discharges by gravity into a convenient receptacle.

Fig. 1 shows the arrangement of the parts of the apparatus diagrammatically and Fig. 2 shows an actual installation in operation. In the diagram, the mixture is pumped into the tank through *A*, and allowed to stand. The tank openings are then closed and discharge valve *D* opened to permit flow of the lower layer into the tail box *T*. Air pressure is put on the liquid through *B* to move the liquid into the tail box. Valve *C* is a vent for use in releasing pressure quickly. When the upper layer comes through into *T*, it is immediately evident and the flow is interrupted to allow the layers to become established in *T*. The lower layer in *T* can then be run into the receiver and the upper layer discharged by air pressure through the sight glass or drawn out through the discharge line as desired.

This equipment has the advantage of simplicity in construction and operation. It is convenient for batches of pilot plant size and since the separation is made visually, permits a high degree of accuracy. It is not necessary to drill, tap, weld or otherwise mutilate a tank which may later be used for another purpose. The method has been used for a separation of two layers, the lower one of which contained solids in suspension and has been found to operate with complete satisfaction. The slot weir in the tail box may be adjusted to give the best working level. As with all tail boxes, two-way control of the level is possible, i.e., by overflow of the weir or drainage through the bottom outlet. This feature is of particular value when separating two layers in the tail box.

## AN EASILY CONSTRUCTED GAGE GLASS FITTING

ARTHUR R. ALBOHN
The Goodyear Tire & Rubber Co.
Akron, Ohio

AN INEXPENSIVE gage glass fitting shown in the drawing can be made with a hacksaw and pipe wrench, using standard pipe fittings available in any plant. While it is meant to be used principally in emergencies when commercial fittings are not available, it will fill the bill quite satisfactorily whenever a gage glass is needed on a tank or drum.

The illustration is practically self-explanatory. After holes for the upper and lower fittings are bored in the tank, the couplings are welded or brazed on, and the piping assembled as shown, using close nipples for a compact assembly. Any pipe size or combination of sizes may be used, although ½ or ¾-in. pipe gave good results and a fairly compact structure.

Only the upper section of a fitting is shown in the packing gland detail. The assembly sketch indicates a tee in this position, although almost any type of fitting may be used. To make the seat for the packing, the lower ¼ or ⅜ in. of a bushing is cut off and threaded into the fitting. The female threads will have to be expanded first, either by threading a pipe section deep into the fitting, or by tapping it a little deeper with a standard pipe tap. This is necessary in order to get the bushing section deep enough into the fitting to leave space for the packing and the gland follower (another bushing).

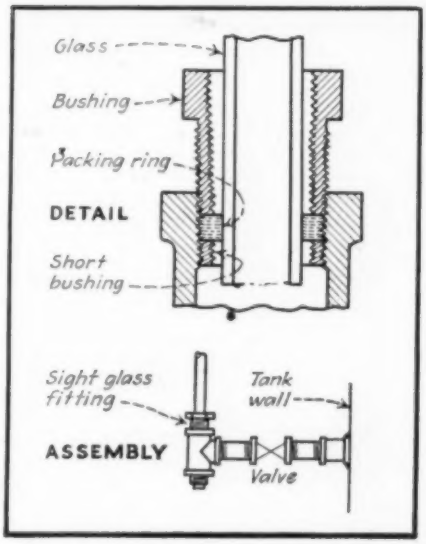
The packing itself can be cut from a variety of materials. A ¼-in. section of soft rubber or vinylite tubing with a rather heavy wall and the proper inside diameter for the glass tubing will be satisfactory, or the gasket may be cut from a rubber stopper or sheeted material with a knife or cork borers. It must be soft enough, however, so that the gland follower can squeeze it against the tubing and the wall of the fitting, to make a good seal at both places.

The bushings used (for ¾-in. pipe) were ¾ x ¼-in., and the glass tubing was chosen to give a somewhat loose fit through the bushing. A moderately loose fit is desirable for easy replacement of broken glasses through the plugged end of the tee. Also, the upper and lower fittings do not have to be perfectly lined up if the glass can be moved slightly in the fitting.

If a closer fit is desirable than standard bushings will give, plugs can be used instead, drilling them to fit the glass tubing as closely as desired.

Protecting rods can be brazed or welded to the body of the fitting if it is to be in an exposed place or is to be used with hazardous liquids.

An advantage of this type of assembly is that the tubing does not have to be cut to an exact length, for it can extend some distance into the fitting at each end. Slipping up or down is prevented by the




**Details and assembly sketch of pipe-fitting gage glass fitting**

## NEW CONTEST RULES

**Plant Notebook Contest entries received during April, and thereafter, will be eligible for a $50 cash prize each month, an increase in immediate cash value of one-third compared with the War Bond previously offered. Beginning with the April issue the rate applying to non-winning articles will be 20 percent greater than formerly.**

## POUNDS PER MINUTE OF MATERIALS THAT CAN BE HEATED THROUGH VARIOUS TEMPERATURE RANGES BY ELECTRONIC HEATERS

(Data from Industrial Electronics Div., Westinghouse Electric Corp., Baltimore, Md.)

| Temp. Rise, Deg. F. | Specific Heat | Power Output of Heater, Kilowatts | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| 200 | 0.2 | 2.84 | 7.10 | 14.20 | 28.4 | 71.0 | 142 | 284 |
| | 0.3 | 1.89 | 4.73 | 9.46 | 18.9 | 47.3 | 94.6 | 189 |
| | 0.4 | 1.42 | 3.55 | 7.10 | 14.2 | 35.5 | 71.0 | 142 |
| | 0.5 | 1.1 | 2.8 | 5.7 | 11.1 | 28 | 57 | 110 |
| 225 | 0.2 | 2.52 | 6.30 | 12.60 | 25.2 | 63.0 | 126 | 252 |
| | 0.3 | 1.68 | 4.20 | 8.40 | 16.8 | 42.0 | 84.0 | 168 |
| | 0.4 | 1.26 | 3.15 | 6.30 | 12.6 | 31.5 | 63.0 | 126 |
| | 0.5 | 1.01 | 2.52 | 5.05 | 10.1 | 25.2 | 50.5 | 101 |
| 250 | 0.2 | 2.27 | 5.68 | 11.36 | 22.7 | 56.8 | 113.6 | 227 |
| | 0.3 | 1.52 | 3.80 | 7.60 | 15.2 | 38.0 | 76.0 | 152 |
| | 0.4 | 1.14 | 2.85 | 5.70 | 11.4 | 28.5 | 57.0 | 114 |
| | 0.5 | 0.91 | 2.28 | 4.56 | 9.1 | 22.8 | 45.6 | 91 |
| 275 | 0.2 | 2.07 | 5.17 | 10.34 | 20.7 | 51.7 | 103.4 | 207 |
| | 0.3 | 1.38 | 3.45 | 6.90 | 13.8 | 34.5 | 69.0 | 138 |
| | 0.4 | 1.03 | 2.58 | 5.16 | 10.3 | 25.8 | 51.6 | 103 |
| | 0.5 | 0.83 | 2.03 | 4.06 | 8.3 | 20.3 | 41.5 | 83 |
| 300 | 0.2 | 1.89 | 4.73 | 9.46 | 18.9 | 47.3 | 94.6 | 189 |
| | 0.3 | 1.26 | 3.15 | 6.30 | 12.6 | 31.5 | 63.0 | 126 |
| | 0.4 | 0.95 | 2.38 | 4.76 | 9.5 | 23.8 | 47.6 | 95 |
| | 0.5 | 0.75 | 1.88 | 3.76 | 7.5 | 18.8 | 37.6 | 75 |
| 500 | 0.2 | 1.14 | 2.84 | 5.68 | 11.4 | 28.4 | 56.8 | 114 |
| | 0.3 | 0.76 | 1.89 | 3.80 | 7.6 | 19.0 | 37.9 | 76 |
| | 0.4 | 0.57 | 1.42 | 2.85 | 5.7 | 14.2 | 28.4 | 57 |
| | 0.5 | 0.45 | 1.14 | 2.28 | 4.6 | 11.4 | 22.8 | 45 |
| 1,000 | 0.2 | 0.57 | 1.42 | 2.84 | 5.7 | 14.2 | 28.4 | 57 |
| | 0.3 | 0.38 | 0.95 | 1.90 | 3.8 | 9.5 | 18.9 | 38 |
| | 0.4 | 0.28 | 0.71 | 1.42 | 2.8 | 7.1 | 14.2 | 28 |
| | 0.5 | 0.23 | 0.57 | 1.14 | 2.3 | 5.7 | 11.4 | 23 |
| 1,500 | 0.2 | 0.38 | 0.95 | 1.89 | 3.8 | 9.5 | 18.9 | 38 |
| | 0.3 | 0.25 | 0.63 | 1.27 | 2.5 | 6.3 | 12.6 | 25 |
| | 0.4 | 0.19 | 0.47 | 0.95 | 1.9 | 4.7 | 9.5 | 19 |
| | 0.5 | 0.15 | 0.38 | 0.76 | 1.5 | 3.8 | 7.6 | 15 |

grip of the packing ring on the tubing. When rubber laboratory tubing was used for the packing finger tightness of the gland follower was all that was necessary to get a tight seal, first lubricating the upper packing surface with a little water or glycerine, so the contact surface of the follower slips easily over the packing, and does not tend to spring back, due to torsional twisting of the packing.

## SIMPLE ENTRAINMENT TRAP FEATURES VISIBILITY

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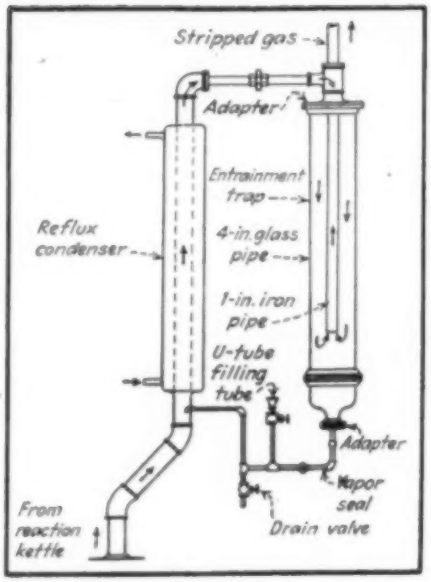
Development Engineer
Schering Corp., Bloomfield, N. J.

IN DEVELOPING a chemical process to pilot plant scale, vapor entrainment was found to present a major problem. Additional condensing surface and variously packed columns proved impractical for solving the difficulty.

The arrangement shown in the accompanying sketch solved the problem very nicely. The entrainment trap consists of a 6 ft. length of standard 4-in. dia. glass pipe. A standard 4-in. to 1-in dia. glass reducer is bolted to the bottom of the trap. An adapter consisting of a flat iron plate with a bolt circle equivalent to the 1-in. flange at the 1-in. end of the glass reducer has a ¼-in. nipple welded on it. From this point a U-tube vapor seal runs back into the bottom of the reflux condenser. The U-tube filling leg enables the U-tube to be filled prior to operation while the drain valve permits product to be withdrawn when the reaction is finished.

The top of the trap has an iron plate adapter with a 2½-in. nipple welded on it and a bolt circle equivalent to the standard flange of a 4-in. glass pipe. A 1-in. iron pipe is screwed through a running bushing at the top of the tee and is inserted into the 4-in. glass pipe. Enriched vapors enter through the annular space at the top of the column and stripped gases leave through the 1-in. iron pipe.

The glass column has the advantage of enabling the operator to observe the efficiency of entrainment removal, especially where the velocity of entrainment vapors is governed by the amount and frequency of addition of reactants.




**Glass entrainment separator applied to pilot plant reflux condenser**

## CHART FOR SHELL AND TUBE HEAT EXCHANGERS

L. H. COOK and RUSSELL TOLMAN
Chemical Construction Corp.
New York, N. Y.

SIZE of a heat exchanger can be determined by the accompanying chart when the total square feet of transfer surface is known. Furthermore, its use eliminates the necessity of a tube sheet layout.

The chart is based on the various geometric relationships which apply to tubes spaced on 60 deg. equilateral triangular pitch. An example showing the use of the chart follows.

Let the total square feet of surface be 2,000 and the length of tubes be 20 ft. Then the square feet of surface per foot of exchanger will be 2,000/20 = 100 sq. ft.

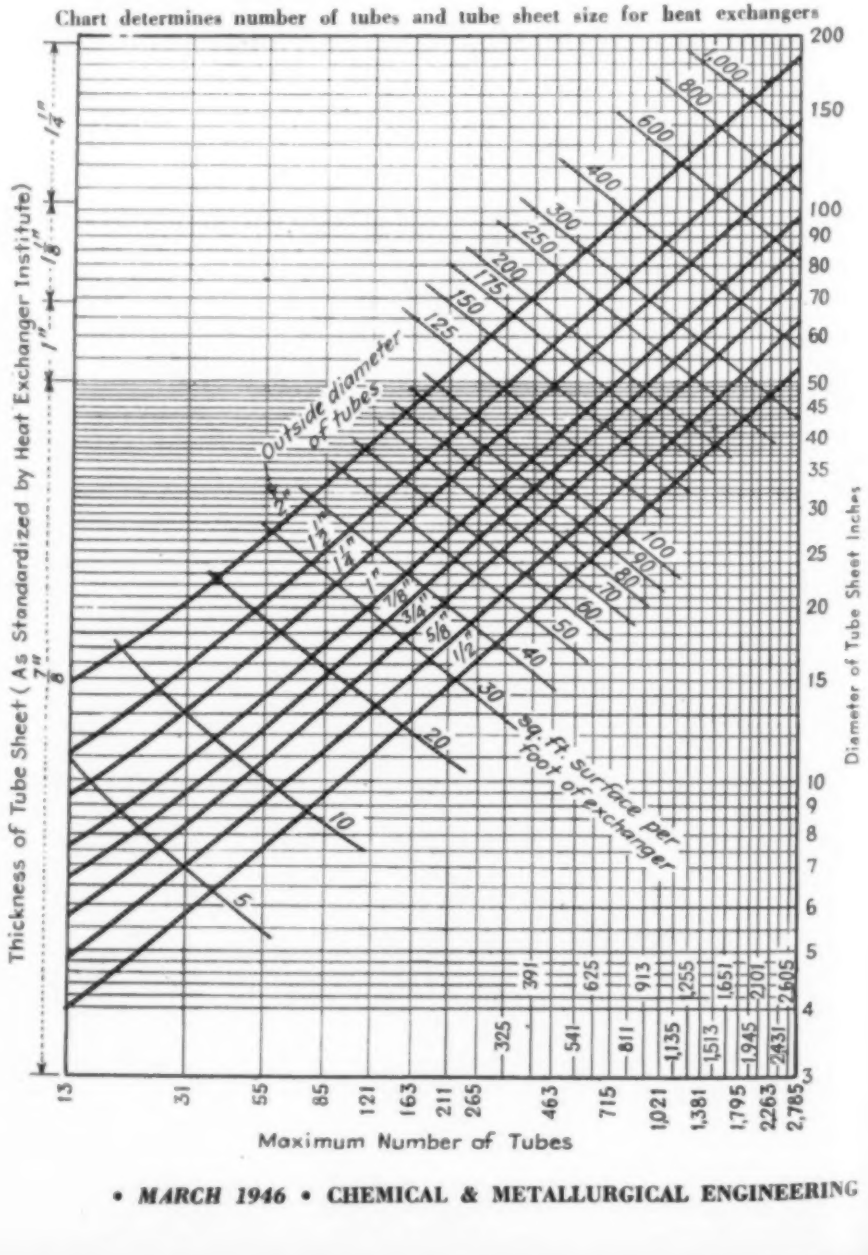
Assume the use of 1 in. O.D. tubes (although any size shown may be used). Follow the 100 sq. ft. curve until it intersects the 1-in. O.D. tube curve; the nearest abscissa value to the right of this intersection is 391 tubes. (Do not interpolate between abscissa values shown on the chart.) The tube sheet diameter is found to be 36.8 in. The tube sheet diameter is always found from the intersection of the abscissa vertical and the tube diameter curve. The tube sheet thickness can be found on the left hand scale opposite the tube sheet diameter. In this example it is found to be ⅞ in.

The chart is based on a pitch $p = 1.5d + 0.125$ in. where $d$ = tube O.D., in inches. For any other pitch the following relationship should be used:

$$D = \frac{P}{3}\left(\sqrt{69 + 12N} - 3\right) + d$$

where $D$ = tube sheet diameter in inches (excluding allowance for flange); $P$ = pitch in inches; $N$ = number of tubes (13, 31, 55, 85, etc., as shown by chart abscissae); and $d$ = tube O.D. in inches.

**Chart determines number of tubes and tube sheet size for heat exchangers**



REPORT ON.....

# EQUIPMENT PROGRESS

## Portrayed at 20th Chemical Exposition

**Although travel restrictions prevented the holding of the 20th Exposition of Chemical Industries at the scheduled time in December 1945, a decision was reached shortly after the close of the war to bring the Exposition to the Grand Central Palace in New York during late February 1946. Short though the time for preparation was, the "Chem Show" gave no evidence of haste in its preparation. Largest Chemical Exposition since the Chemical and Power Shows were separated in 1922, and probably the best attended on record, there was considerable evidence of development, both in equipment and in materials, and an exceptionally fine job of display was usual. The prevalent strikes had some adverse effect on the displays, since some of the intended exhibits could not be shipped or could not be completed in time.**

Bigger and better than ever, according to the general concensus, the "Chem Show" returned to the Grand Central Palace in New York during the week of Feb. 25, after its last wartime appearance at Madison Square Garden. Everyone agreed that this 20th assembly of the chemical equipment and chemicals classic was better off for the return to its old home, where ceilings were much higher, far more space was available and the old friends of the Show were once more back in familiar surroundings. As this report was written, before the doors finally closed on the 1946 showing, and before the final figures were tabulated, it appeared that attendance would break all previous records, with something over 10,000 visitors a day for the six-day period. As for exhibitors, there were some 378 of them listed, a figure that included a number of duplications of subsidiary companies that did not have separate showings, but the actual number, if we include the various clients of manufacturers' representatives whose equipment was exhibited, was in the neighborhood of 350. With four floors occupied, the space taken by exhibits was greater than at any time since 1922. Before that the Chemical and Power Shows had been combined.

A breakdown of the exhibits indicates that nearly 280 showed plant scale equipment (including control instruments, packaging supplies and packaging equipment); 26 dealt largely with chemicals; 46 were primarily concerned with special materials of construction; while 25 were publishers, societies and consultants. Some 30 exhibits dealt exclusively with laboratory equipment and supplies. The report that follows is limited to plant scale equipment and instruments, and materials of construction, and covers only those developments exhibited at the current Show that have been introduced commercially since the last New York Chemical Show in December 1943.

### FILTERS AND CENTRIFUGALS

Exhibiting its improved Sealed-Disc filter, Alsop Engineering Corp., Milldale, Conn., indicated that this new unit, which is of the horizontal disk pressure type, may now be had in stainless steel, Monel or other corrosion resisting materials, at low cost. The filter comes either with or without a pump, in sizes of 1 g.p.m. upward. Changing filter disks is claimed to be extremely rapid and easy.

A novel development in automatic back-washing sand filters was exhibited by the Hardinge Co., York, Pa. This filter, developed recently by W. C. Laughlin, is used mainly for the treatment of sewage, industrial wastes and water supplies, and for the removal of light and fine suspended matter not readily separated from liquids by sedimentation methods. The filter consists of a special compartmented sand bed with underdrains, surmounted by a back-washing carriage which travels slowly from one end of the tank to the other, automatically stopping discharge through any section undergoing back-washing. The carriage is equipped with two pumps, one taking filtrate from the effluent channel and pumping it back through the sand bed, the other removing dirty wash water which passes up through the bed and is collected in a cleaner hood attached to the carriage and suspended over the sand. Wash water is discharged through a separate wash water launder.

Among the recent modifications in vacuum filters displayed by Oliver-United


Filters, Inc., New York, are the new Panel type rotary vacuum filter and the horizontal rotary filter. The first of these requires no wire winding of the drum, each panel being separately clothed, with the cloth caulked in. Very light air pressure is needed for discharge and the filter is adapted to dilute feeds, slow filtering materials and a thin cake. The second type, an adaptation of the Oliver sand washer, employs an annular rotating trough containing horizontal filter leaves forming its bottom. Wet material enters at one side, is filtered and washed as the trough rotates, and is removed by a rotating scroll or other discharger just before the trough returns to the feed point.

Selas Corp. of America, Philadelphia, demonstrated a 1,000-g.p.h. Selaseparator for the first time at the Chemical Show. By combining certain basic principles borrowed from the fields of capillary physics and surface chemistry, this equipment secures complete phase separation of immiscible liquids by means of their interfacial tension. Such units are at present operating on such process applications as the breaking of emulsions on steam distillation streams, the separation of water from oils where the water is present as a good stabilized emulsion, and the separation of water from gasoline and other hydrocarbon liquids. The device makes use of treated, porous ceramic filters.

Among new centrifugals at the Exposition was the Super-D-Canter, a horizontal-shaft continuous centrifugal of the imperforate-bowl type, introduced by the Sharples Corp., Philadelphia. Available at present only in the 22 x 14 in. size, the unit operates at 3,450 r.p.m. and is built of stainless steel. It is adapted to the continuous handling of solids-containing liquids, both for clarification and for classification at fine particle sizes. This same company showed an improved model of its Super-D-Hydrator automatic, semi-continuous bulk centrifugal which showed evidence of considerable streamlining of the design. This centrifugal can now be provided in a vapor-tight design, if desired.

In the exhibit of T. Shriver & Co., Harrison, N. J., was a new inclosed-tank, horizontal-plate, vapor-tight pressure filter for clarification, decolorizing and other filtering operations on any filterable material. Any type of filter medium including paper, cloth or asbestos pads can be used, together with any suitable filter aid. The unit consists of a series of horizontal grooved plates which are slipped over a central column, separated by sheets of filter medium. Up to 60 g.p.h. flow per sq. ft. of filtering area is claimed. Slurry is fed through the center of the plates and clear filtrate discharges into the tank. Hence no unfiltered material can be left in the tank.

A new model of the Wright cord filter, differing markedly in principle from the earlier cord filter exhibited by the well known filtration engineer, Arthur Wright, a few years ago, was shown by the Filtration Department of Titeflex, Inc., Newark, N. J., in the booth of Goslin-Birmingham Mfg. Co. In the original Wright cord filter the filtering medium consisted of a series of cords operating like a rope drive on a vacuum filter drum grooved like a sheave. Filtration took place between the cords and the sides of the drum grooves. In the new model a much simpler arrangement, which is claimed to be definitely superior, is used. The face of the filter drum is divided into shallow compartments by a number of cross members serving as separators. The single continuous cord is laid down on the drum in a very ingenious fashion. First a single layer of cords is laid down, wound many times around the drum and over a series of rollers; then a second layer of cords is laid down, filling the interstices between cords of the first layer, and these cords also pass over rollers for discharge and for washing of the cords after discharge. By varying the weave of the cord, or the cord coating that may be applied to it, the porosity of the filtering medium can be varied over a wide range and it is claimed that this method, which is said to be suitable for application to any type of rotary vacuum drum filter, can thus be applied to practically any filtering problem.

Developed primarily for pilot plant use, to permit the best operating speed to be determined, is the new 26 in. variable-speed suspended centrifugal exhibited by Tolhurst Centrifugal Division of American Machine & Metals, Inc., East Moline, Ill. Driven through an Allis-Chalmers variable-speed Texrope drive, the machine permits any speed in the range from 670 to 2,150 r.p.m. to be used, giving a centrifugal force range from 170 to 1,700 times gravity. A centrifugal clutch is provided to permit unloading at low speed. The unit is designed for interchangeability of perforate and imperforate baskets and hence is to be used for both filtering and settling separations.

## FLUIDS HANDLING

*Pumps*—Among the pumps exhibited by Allis-Chalmers Mfg. Co., Milwaukee, was the new type CW centrifugal slurry pump for handling liquids containing high percentages of solids in suspension with, it is claimed, efficiencies comparable with those for ordinary high-efficiency, clear-water pumps. This company also showed a new small model of a self-priming, single-suction centrifugal pump that is available in sizes from 1½ to 6 in., for capacities up to 1,400 g.p.m., at 100 ft. head. The pump is claimed to give extremely rapid priming and high lift at high efficiency.

Designed to pump small volumes of non-lubricating liquids at pressures up to 200 lb. per sq. in., its GW Models 1 and 2 gear pumps were exhibited by the Eastern Engineering Co., New Haven, Conn. These pumps are built in such a manner that no lubrication is necessary, eliminating the possibility of contamination of the liquid being pumped. By using a large surface of especially developed inert material, unit bearing pressures have been held to a minimum. This pump is direct-connected to its drive motor. Model GW-1 will deliver approximately ½ g.p.m. at 0 to 200 lb. per sq. in., and Model GW-2 will deliver 1 g.p.m. at 0 to 130 lb. per sq. in.

Its new Type G vertical, self-priming centrifugal pump, which has neither packing nor conventional rotating seal, was exhibited by the LaBour Co., Elkhart, Ind. The novel feature is a centrifugal seal which absorbs no power, is said to outlast the pump rotor, requires no maintenance, and cannot be damaged by solids carried in the liquid pumped, or by the formation of crystals. The seal is similar in section to the volume that would be formed if a

horizontal U-tube were rotated about a vertical axis. Sealing results when liquid is "packed" into the bend of the U by centrifugal force as the pump operates.

Lapp Insulator Co.'s Process Equipment division, LeRoy, N. Y., showed an improved version of the Wilson Pulsafeeder proportioning pump. It has a newly designed pumping head of Lapp chemical porcelain. Reagent heads in plastic and in virtually all metals and alloys can be supplied for special reagent handling problems. Available valve structures include an exclusive rubber crown development, to be used for slurry problems. A pressure overload valve releases excessive pressures built up by line resistance, in protecting the pump and piping system from wear and breakage due to line stoppage or accidentally closed valves.

Two new gear pumps, representing two new lines, were exhibited by the Marco Co., Wilmington, Del. Both lines are constructed of stainless steel or other special alloys and both have automatic wear compensation. The "Victor" line consists of four relatively small volume (45 to 332 g.p.h.) gear pumps which require no lubrication. The "De Luxe" line is for heavy duty service, handling from 500 to 4,000 g.p.h. against head pressures up to 100 lb.

The McIntyre Co., Newton, Mass., introduced its Series 100 gear pumps for the first time at the Chemical Show. This series features greater flexibility, smaller size, lighter weight and lower cost. The pumps are designed to displace from ½ to 3 g.p.m. of non-corrosive liquids, at pressures from 0 to 1,000 lb. Suitable construction can also be provided for pumping 1 to 2 g.p.m. of mild corrosives against pressures to 200 lb.

Schutte & Koerting Co., Philadelphia, displayed its Hydro-Steam vacuum unit which will maintain vacuum in ranges up to 1 mm. absolute. This is a self-contained portable unit available in six standard sizes with a water jet vacuum pump and one, two or three stages of steam jet boosters. The steam jet exhausters operate in series and discharge into a water jet exhauster which serves both as a condenser for the actuating steam and as a low vacuum jet. The water discharges from this exhauster into a specially designed chamber where it is stored for reuse recirculation to the exhauster, and where non-condensible gases are liberated.

Improvements in its line of vacuum pumps for operation in the millimeter range were exhibited by F. J. Stokes Machine Co., Philadelphia. The new pumps employ a top-mounted motor and are considerably smaller for the same capacity than earlier pumps. It is claimed that pump efficiency has been increased by 10 to 15 percent.

*Pipe and Fittings*—Barco Manufacturing Co., Chicago, Ill., displayed its new Type X streamlined flexible ball joint fitting which incorporates design factors aimed at promoting long life and freedom from leakage of fluid or gas. The new feature of this joint is that the pressure of the spring that forces the ball against its single gasket is applied at exactly the center of the ball to minimize friction and resistance to angular movement. The stainless steel spring is shrouded so that it has considerable protection against the corrosion and erosion of fluids passing through the joint.

A new spring pipe hanger, Model Fig. B268, made by the Grinnell Co., Providence, R. I., consists of a precompressed spring incased in a container. It has a direct-reading scale and scale pointer on the side of the casing for reading the tension or load.

Shown by the Monarch Mfg. Works, Philadelphia, the new air-oil atomizing nozzle, Model C-170, is available in capacities to handle 3 to 37 g.p.h. for use in commercial or industrial burners. Machined from ordinary steel, this nozzle contains a patented mixing device said to insure complete mixing.

New steam specialties exhibited by the Sarco Co., New York, included two extra-capacity thermostatic steam traps, a new high-pressure thermostatic trap, and a smaller series of low pressure thermostatic traps. A new scraper strainer for pipelines, designated as Type VRS, is similar to the earlier SRS type except that the screen is at right angles to the flow, instead of inclined, and hence takes less space and is lower in cost. However, it has somewhat smaller capacity. Both hand and motor driven scrapers are produced.

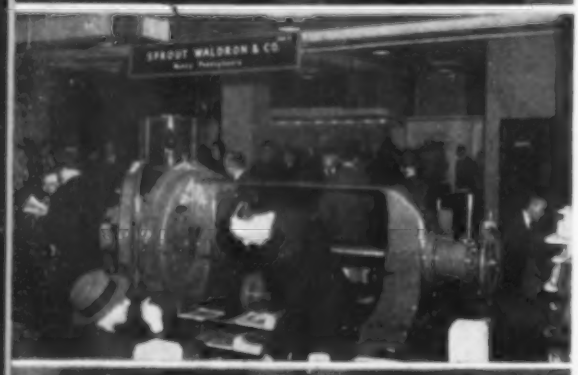
*Valves*—Quite a number of new valve designs were shown in the exhibit of Alloy Steel Products Co., Linden, N. J. They included the following: 600-lb. solid wedge gate valves with A.S.A. raised flanges in 1 to 12 in. diameters; 600-lb. solid wedge gates with A.S.A. ring joints in 1 to 12 in. diameters; 300-lb. split wedge valves with A.S.A. flanges and raised or ring joints (two series) in 1½ to 6 in. diameters; 300-lb. solid wedge valves with A.S.A. flanges and raised or ring joints (two series) in 1½ to 12 in. diameters. All these types are available in stainless steel types 304 and 316. Also shown was a 150-lb. V-port valve, for throttling or metering, with flange ends in ½ to 4 in. diameters; a 150-lb. globe, retained gasket, flange end valve in ¾ to 6 in. diameters; and a 150-lb. sampling valve with flange ends in ¼ in. diameter only. Both stainless steels mentioned and the company's Aloyco 20 can be used for the latter valves.

Black, Sivalls & Bryson, Kansas City, Mo., exhibited for the first time a patented pressure-vacuum vent valve for storage tanks. The pressure in the tank seats the flexible neoprene or other synthetic rubber gasket securely upon the rim of the body. The higher the tank pressure, the tighter the valve holds, until the over-pressure lifts the hinged cover and breaks the contact. If vacuum develops in the tank, atmospheric pressure lifts the valve gasket so that in-breathing can occur.

Nordstrom Valve Co., Pittsburgh, exhibited a new line of stainless steel cocks in sizes from ½ to 4 in., available in both screwed and flanged patterns. A new application of this company's Merchrome coating is its present use on all stainless steel cocks. The coating, applied either to the plug, or to the body, or both, is said to avoid the possibility of galling. This company exhibited the new silicone grease for plug cocks developed by Dow-Corning Co., as well as a number of other new stick type lubricants for lubricated plug cocks.

## GRINDING AND PULVERIZING

A featured exhibit of the W. J. Fitzpatrick Co., Chicago, was its Model D comminuting machine, with newly developed blades. The blades are hardened, tempered stainless steel, with concave-surface cutting edges for granulating, and precision sizing. They have a serrated impact side for pulverizing. Operating speed ranges of 500 to 5,000 r.p.m. may be used for wet granulation, dry granulation, pulverizing.



dispersion or wetting, milling of ointments, and sizing of crude drugs.

A new type of hammer mill was exhibited by Jeffrey Mfg. Co., Columbus, Ohio. This mill, adapted to either wet or dry grinding in the same machine, is equipped with several water sprays to prevent plugging when grinding wet. The grinder is of the screen type, with about 40 percent screen area, and the same mill can accommodate either a 5- or a 3-hp. motor. This mill was shown controlled by the company's new EA2 automatic electronic amplitude control, which operates in conjunction with a vibrating feeder that supplies material to the mill in direct proportion to the ampere demand.

A recently developed mechanical screenless pulverizer for production of ultra-fine powders from 1 to 25 microns and known as the Mikro-Atomizer, was displayed by the Pulverising Machinery Co., Summit, N. J. The Mikro-Atomizer is essentially a double impact mill employing a rotor so designed as to divide the feed into two streams. It is flanked by separator wheels which, by the opposing forces of centrifugal action and aerodynamic drag reject all large particles back into the path of the rotor and draw the exceptionally fine finished particles to the discharge. The dispersion rings which provide for intimate and instantaneous dispersion of powdered particles with air as they leave the impact members are assembled one on each side of the separator wheels. They direct the flow of outside air which enters the mill from annular slots in the mill casing in an axial direction across the ends of the separator wheel vanes, creating a dispersion of air and particles to permit efficient selection of the finished particles which are drawn radially into the separator wheels. A fan is mounted at each end of the mill, close to the dispersion ring, to draw the necessary air into the mill and discharge the finished product into a collector.

Also indicative of the trend toward finer grinding for many types of products is the new vertical impact mill shown in the booth of Raymond Pulverizer Division, Combustion Engineering Co., Chicago. This high-speed mill is air-swept, employing a built-in fan and a double whizzer classifier for particle size control. The mill operates in the lower micron range, with no material left on 325 mesh. Its grinding element is of the swing-hammer type. The smaller 18-in. mill requires a maximum of 20 connected horsepower and the larger 35-in. mill, a 100-hp. motor. A cooling water jacket is provided around the periphery of the grinding chamber.

Sprout, Waldron & Co., Muncy, Pa., displayed a disk-type grinder for the grinding and refining of a variety of paper mill materials ranging from screen rejects to cooked pulps. This rotary disk refiner has peripheral control so that adjustment independent of grinding plate adjustment can be made. This clearance is determined by means of dial indicators on the peripheral control. One set of plates is fixed to the mill shell and the other to the rotating disk. Stock is introduced in the center between the grinding plates and discharges around the periphery. The plates operate at very close clearances, but need not actually rub or touch, thus assuring a long life. Changes in characteristics of the finished pulp are secured through the selection of plate design, variation in consistency, and disk setting.

Union Process Co., Akron, Ohio, displayed the Szegvari Attritor, a novel departure in ball mill type grinding equipment. The charge to be wet ground is placed in a tank where it intermixes with pebbles used as the grinding element. An agitator keeps the entire system in continuous interaction at moderate speeds. The tank, grinding element and agitator are made of special materials to resist the intensive attrition. A cooling jacket absorbs the generated heat.

## HEAT FLOW

An industrial immersion-type heater in sizes up to 20 ft. long was exhibited by the American Instrument Co., Silver Spring, Md. Used in pickling, plating and other similar tanks, this heater consists of a nickel chromium element within a copper, lead, steel or stainless steel tube. It consumes up to 5,000 watts. In tanks where one heating element is not sufficient more than one may be used. A small size immersion-type heater which is equipped with an automatic control element is available in sizes up to 14½ in. long for use in small water heaters and similar applications.

An interesting development in heat transfer was exhibited in the booth of the Aluminum Co. of America, Pittsburgh, Pa. This concern showed balls of corundum in sizes from ¼ to 1 in. diameter to which the name "tabular alumina" has been given. It is understood that active work is going ahead in the petroleum industry, looking toward the use of these high temperature resistant balls as a temperature stabilizer in certain catalytic operations. Presumably they are employed to absorb heat in an exothermic stage of the process and give it up at a later endothermic stage.

An improvement in refractories was the medium-weight Alfrax B.I. brick exhibited by the Carborundum Co., Perth Amboy, N. J. This brick, which is suitable for temperatures up to 1,800 deg. C., consists essentially of fused alumina, the grains of which are initially produced in bubble form.

Intended primarily for experimental use, a new electric heated Dowtherm vaporizer shown by Foster Wheeler Co., New York, is produced in sizes of 50,000, 100,000 and 150,000 B.t.u. per hour.

Displayed by the Patterson-Kelley Co., East Stroudsburg, Pa., was a new type billet head used on thermal expansion type water and brine heat exchangers. Ordinarily the heads used on such coolers are somewhat porous and allow the escape of such refrigerants as Freon. The new head is made of forged steel which is non-porous compared to the cast heads generally used.

Its new line of standardized heat exchangers, produced in stainless steel, was exhibited by the Pfaudler Co., Rochester, N. Y. These exchangers, available in sizes from 5 up to 1,000 sq.ft., are produced in four types, including: (1) An exchanger with fixed tube sheets; (2) a floating-head, outside-packed exchanger; (3) a floating-head, internal-packed exchanger; and (4) an exchanger with hairpin tubes.

## INSTRUMENTS AND CONTROL

*Industrial Instruments*—Two new instruments were exhibited by American Meter Co., New York. One of these is a flow controller of the reset type employing a flapper type air valve instead of the rotary type formerly used. The instrument consists of five major sub-assemblies, each of which is interchangeable with other reset control instruments of the company's line. The instrument is adjustable in throttling range from less than 1 to over 200 percent. The other instrument is an air-operated remote indicator which can also be applied to recorders and controllers. An improved type of flapper pilot valve is used, as in the case of the reset controller.

Builders-Providence, Inc., Providence, R. I., displayed an inexpensive, simple, compact, easy-to-read Flo-Gage that can be used as a rate of flow indicator for water, steam, and air. It consists of a bellows-type pressure gage, for differential pressure ranges of 30 in., 60 in., 100 in., and 200 in. of water. The gage mechanism is inclosed in a heavy semi-steel chamber having a thick pre-stressed glass window, designed for operating pressures of about 500 lb. This chamber is filled with a neutral transparent fluid. The high-pressure line from the differential producer leads to the operating bellows of the gage mechanism, and the low-pressure line, to the inside of the chamber housing the entire gage. The instrument is said to measure flow within 2 percent of full scale.

Coleman Electric Co., Maywood, Ill., exhibited for the first time a self-contained electrode assembly in a single unit for either industrial or laboratory pH measurements. This new electrode assembly is said to be advantageous since it is easy to clean, and is not easily contaminated.

In the booth of the Davis Emergency Equipment Co., Newark, N. J., a variety of gas analyzing equipment was displayed. A new portable flue gas analyzer called the "Stack-O-Meter" measures draft, temperature and percent $CO_2$ from 0 to 20 percent on the same scale. The thermal conductivity principle of analyzing gases is used. The company also showed a stationary continuous recording instrument for taking the same measurements, as well as instruments for detection and measurement of combustible gases and vapors. The latter are of the type in which a flammable gas-air or vapor-air mixture is burned at the surface of a glowing filament so that the combustion raises the temperature of the filament and unbalances a wheatstone bridge.

Several new instruments were shown by the Fischer & Porter Co., Hatboro, Pa. A rotameter was included that will measure drop-by-drop flows in quantities as low as 10 cc. per min. Recording and indicating control of such small quantities is obtained by use of the Rota-Tronic electronic instrument which actuates a pneumatic automatic control system to position a diaphragm valve in the flow line. The model shown was able to control within 1 percent plus or minus, from 10 to 40 cc. per min. of water.

A full line of pneumatic transmission equipment is now available for use with this company's indicators, controllers and recorders. A new ratio control mechanism consists of suitable linkages and gear mechanisms which physically connect two remote-reading, recording and controlling rotameters together, so that one of them is forced to follow the other in a definite ratio.

A continuous viscosimeter was also shown, consisting of a modification if the rotameter in which two metering floats operate in the same tube. The lower float is viscosity immune and is used for manual adjustment to a specified predetermined flow rate. The second float, which is viscosity sensitive, rides above the first and indicates viscosity. A built-in thermometer allows temperature corrections to be made. Automatic constant flow can be provided by special attachments.

Gotham Instrument Co., New York, N. Y., exhibited for the first time a complete line of air-operated controllers, which is now available on recorders and indicators, for use in temperature and pressure applications. Also displayed was this company's line of indicating pressure gages. H. B. Instrument Co., Philadelphia, displayed a mercury-thallium thermometer claimed to be accurate to —61 deg. F., or possibly lower.

Precision indication of the dew point of any kind of gas is the function of the new dew point indicator developed by Illinois Testing Laboratories, Chicago. Made in two models, the indicator operates by introducing a sample of gas or air into an observation chamber where, after temperature stabilization, visible condensation is produced and made evident by a beam of light in the observation chamber when the operating valve is depressed. The dew point temperature is then read from a chart based upon an initial temperature and the ratio between initial and final pressures of the gas.

Industrial Instruments, Inc., Jersey City, N. J., displayed a new electrolytic conductivity recorder incorporating a null-balance a.c. wheatstone bridge circuit. The recorder can be furnished for one, two, three or four continuous line records on the same 12-in. diameter circular chart, a separate amplifier and motor-driven slide wire being used for each recording pen so that no switching devices are necessary. Another instrument shown by this concern was a halogenated hydrocarbon analyzer, for continuous determination of atmospheric concentrations of such compounds. A continuous record is given. In operation, a constant stream of air mixed with hydrogen in fixed proportion is passed through a quartz combustion tube maintained above 800 deg. C. Under these conditions decomposition to the corresponding hydrogen halide, such as hydrogen bromide or hydrogen chloride, occurs. The halide is continuously absorbed in a measured stream of water and the electrical conductivity of the water solution is measured and recorded. This analyzer is licensed from Westvaco Chlorine Products Corp.

The MSA Oxygen Indicator is now available from Mine Safety Appliances Co., Pittsburgh, for the measurement of oxygen in mixed gases. It is built in four scale ranges as follows: 0 to ½ percent, 0 to 5 percent, 0 to 10 percent, and 0 to 25 percent. The element consists essentially of an electrolytic cell contained in a plastic case. A zinc plate electrode and carbon tube make up the cell. The sample is passed through the carbon tube where oxygen diffuses through the carbon to combine with hydrogen formed by the electrolytic action of the cell. This reduces the internal electric resistance of the cell and current produced is proportional to the partial pressure of oxygen in the sample.

Another piece of equipment developed during the war is the MSA explosion-proof combustible gas recorder and controller. Here the sample is drawn over a heated platinum wire where the combustible material is burned, thus increasing the temperature and unbalancing a bridge circuit. As many as eight different points can be sampled automatically with a single analyzer. Control is available if desired. This equipment finds use on coating machines where a flammable solvent is used and in solvent recovery.

Proportioneers, Inc., Providence, R. I., displayed an automatic loss-in-weight scale and ethyl fluid blender for the first time at the Chemical Show. The equipment consists of a horizontal ethyl fluid storage tank mounted on a 60-ton double-beam scale. A venturi tube and a Chronoflo transmitter measure the rate of flow of gasoline and translate it by means of a timed electrical impulse to a poise retraction mechanism. There is a clutch assembly, drive mechanism, and control instrument for retracting the poise weight on the graduated balance beam of the tank scale by means of a constant pitch screw at a rate proportional to the changing flow of fluid through the venturi tube. A pneumatic control system regulates the rate of liquid withdrawal from the weigh tank. Safety devices are provided to



indicate failure of pump, air pressure or vacuum or other contingencies.

Milton Roy Pumps, Philadelphia, exhibited a new automatic pH control system, suitable for use where both the flow and pH are variable. It is claimed that pH may be controlled without "hunting" and that a higher degree of uniformity is obtained. Length of stroke of the pump is controlled by the pH controller, while the pump speed is controlled through a variable speed motor by the rate of main line flow.

An improved version of its Hydromotor-valve temperature control was exhibited by the Sarco Co., New York. This electrically operated controller attains throttling characteristics by the use of a small motor driving an oil pump at an average speed proportional to the temperature demand. The output pressure is applied to the bellows controlling the valve opening and hence produces a flow through the valve proportional to the demand.

Continuous indication of specific gravity of fluids is possible with a specific gravity indicator made by Schutte & Koerting Co., Philadelphia. This consists of a special modification of a standard rotameter body. The liquid enters the bottom, passing up through the glass tube to a level which is kept constant by an overflow pipe. A standard hydrometer of any given range can be placed inside the tube where it indicates the specific gravity of the flowing liquid.

Once an instrument largely for laboratory use, the McLeod high vacuum gage has been developed into a portable, rugged model by F. J. Stokes Machine Co., Philadelphia. The instrument shown has been completely redesigned and employs a built-in trap for condensible vapors to give accurate readings within the micron range, even when such vapors as water, oils and alcohol are present in the vacuum system. This trap consists of a compact, renewable chemical cartridge which by change in color of the chemical indicates when it must be renewed.

An improved Type S Tankometer for measuring liquid levels was shown by the Uehling Instrument Co., Paterson, N. J. The standard instrument consists of a bubbler type hydrostatic gage which normally uses compressed air for operation. The gage now, however, is equipped with a hand air pump which may be used for spot testing if the regular air supply should be cut off. Also available now is a straight U-tube type manometer in which two straight tubes are set in a U block for measuring differential pressure. This feature aids in maintenance, assembly and disassembly.

*Special Instruments*—One of the featured instruments exhibited at the Chemical Show was the so-called leak detector which played such an important part in the development of the gaseous diffusion plant at Oak Ridge, Tenn. This instrument, a special adaptation of the mass spectrometer, which was manufactured in quantity by the General Electric Co., Schenectady, N. Y., is a portable unit capable of detecting concentrations of helium as low as one part in 200,000 parts of air. The device has a quick response, requiring about one second to operate. Since it is adjusted to detect helium gas, it is used with a probe of helium to explore the outside of the system, or if the system is surrounded by helium, any leak into the system will admit helium. The detector consists of a mass spectrometer tube and the necessary electronic circuit, together with a diffusion pump, a rough vacuum pump of the rotary oil type, a thermocouple vacuum gage, an ionization gage for high vacuum measurement, a control panel and the necessary batteries and battery charger.

Now used for continuous automatic measurement and control in various processes, the Beckman recording ultra-violet spectrophotometer was displayed by the National Technical Laboratories, South Pasadena, Calif. This instrument consists essentially of an ultra-violet lamp; a monochromator which serves to isolate the wave length of interest; a sealed absorption cell through which the sample streams, a photocell and associated amplifier which develops an output voltage in relation to the transmitted light; and a recorder on which the potentials are recorded on a chart calibrated directly in percent transmission. Developed originally for continuous analysis of butadiene streams, the instrument is useful for other materials which have spectral absorption in wave lengths between 220 and 360 millimicrons. For continuous automatic operation the instrument receives a continuous flow sample and is operated at some characteristic single wave length.

The Beckman infra-red spectrophotometer is similar to the instrument just described except that it employs a rock salt prism instead of a quartz prism. This instrument was used extensively for hydrocarbon analysis in aviation gasoline and butadiene plants during the war. The optical system is similar to that of the ultra-violet spectrophotometer except that the absorption sample precedes rather than follows the monochromator. Details of both of these instruments were given in *Chem. & Met.*, July 1945, pages 119 to 126.

Perkin-Elmer Corp., Glenbrook, Conn., also exhibited its infra-red spectrophotometer, complete with automatic recording accessories. Consisting of a multiple speed wave-length drive for automatic scanning of the spectrum, a recorder and amplifier, the spectrometer and all its accessories are mounted in a single cabinet and the resulting spectrum appears directly as a graph characteristic of the sample.

Displayed for the first time at the Chemical Show was a commercial low-voltage, long-wave-length radiographic unit made by Picker X-Ray Corp., New York, for work on cigarette paper, thin, light alloys, plastics, and other low density materials. It can be used in the study of weaves, glue distribution in plywood, and distribution of asbestos fibers when used as packing or insulation. It is used to determine quality and structural comparisons of imitation or real leather and to check distribution of filler in rubber.

North American Philips Co., New York, displayed the Norelco Geiger-Counter X-ray spectrometer recorder to give an automatic pattern recording of X-ray diffraction of a sample. To operate the spectrometer a small amount of the specimen is powdered, and mounted on a flat slide inserted in the specimen holder. The specimen intercepts a fine X-ray beam in such a manner as to deflect portions of the beam at various discrete angles over a quadrant scale. These intensities are then measured and recorded electronically by automatic scanning, and provide a means of identifying the crystalline form of the material.

An electronically operated, falling-ball viscosity meter with an automatic timer attachment was shown by Tech Laboratories, Jersey City, N. J. The meter range has

been increased so that viscosity as low as 50 centipoises may be measured. Very high viscosity may be measured in a shorter interval of time, and by using balls of a different density the time required may be varied to suit the individual. By means of electronic indication the instrument is said to work better for completely opaque materials than does the visual method of timing the ball in clear solutions. For these reasons the instrument is claimed to be advantageous as a plant control instrument, and to be capable of making large numbers of reliable viscosity measurements in a short time.

Will Corp., Rochester, N. Y., showed a portable apparatus (12x12x8-in. box) for the rapid determination of carbon monoxide in concentrations down to 5 or 10 p.p.m. The determination is based upon the titration of the iodine produced from the reaction of CO with iodine pentoxide.

## MATERIALS HANDLING

New material handling devices were numerous. The Barrett-Cravens Co., Chicago, exhibited its redesigned and improved Power Ox truck which is more flexible and easier to operate and maintain than the old model. The truck is designed to operate with any size pallet or platform, single- or double-faced. It is available in two capacities, 4,000 and 6,000 lb., and in two standard widths of 19 and 25 in. It can be obtained with foot, hand or power lift. The power for horizontal operation is supplied by storage batteries to a special compound-wound, high-torque motor.

A drum stacker built by the West Bend Equipment Corp., West Bend, Wis., was exhibited in the booth of Albert H. Cayne, New York. The motor driven hoist will lift 1,500 lb. to a height of 20 ft.; the stacker is mounted on casters for hand propulsion. In the same booth were several materials handling developments of Speedways Conveyors, Inc., Buffalo, N. Y. One, a new Speedlift belt conveyor, is 12 ft. long and is adjustable to any position from horizontal to an angle of 35 deg., in which position it reaches a maximum elevation of 8 ft. 6 in. In a horizontal position it will move 250 lb. at 50 ft. per min., and at 35 deg., it will move 150 lb. at 50 ft. per min. It is designed for use as a booster in a gravity conveyor line or as a stacker. Another interesting item built by this concern is a Y switch for use in skate-wheel type gravity conveyor lines. One section of the switch is hinged so that it can be flipped to guide material to either of the two branches.

A new Speedways gluer was also displayed in a Shate wheel conveyor line, consisting of two 4½ in. diameter serrated steel wheels which roll in a glue bath and apply glue to the bottom of passing cartons. The purpose of course is to facilitate unit-loading of cartons or to insure against slipping and shifting during handling and transportation. This concern's Speedveyor, also shown, is a motor driven belt booster for gravity conveyor lines. It is available in various sizes from 5 to 30 ft. in length and 12 to 18 in. in width. It is 32 to 50 in. high, on telescopic legs, and operates at 5 to 50 ft. per minute.

"The only 4,000 lb. industrial high-lift truck on pneumatic tires" is the description given a new gasoline-driven, high-lift truck introduced at the show by the Hyster Co. of Portland, Ore., and Peoria, Ill. The Hyster 40 is characterized by trunnion steering, an overhead steel canopy for driver protection, conventional automotive controls and self-contained hydraulic lifting and tilting units. The lifting mechanism will tilt 4 deg. forward, 10 deg. backward, and raise a 4,000 lb. load 108 in. above the floor.

Several new materials handling devices were displayed in the booth of the Island Equipment Corp., New York. The first is a straight line unscrambling table by means of which one operator can unload from 60 to 240 of any size bottle, jar or container per minute from cartons on to a conveyor which discharges them in a single line to the next operation. The company also showed a can conveyor with a steel or stainless steel linked-plate belt 3¼ in. wide, a new revolving accumulating table, a motor driven flat belt assembly-line work table, a self-contained power unit for converting any non-power conveyor into a power conveyor, and a motorized package piler, or stacker.

Exhibited by Jeffrey Mfg. Co., Columbus, Ohio, was a rotary bin check valve which connects to the bottom of a conical hopper. It contains an agitator which tends to feed material continuously into a horizontal rotating star-shaped member that meters the material and moves it to the discharge point. This concern also showed a new bin level indicator consisting of a flange carrying a flexible diaphragm actuating a mercury switch. An adjustable counterweight holds the switch in one position when the diaphragm is unloaded, reversing the switch as material builds up against the diaphragm.

The Metzgar Co. of Grand Rapids, Mich., introduced its Power Helper, a motor-driven belt conveyor designed to act as a booster in gravity conveyor lines. The conveyor is mounted on rubber-tired wheels, can be adjusted from horizontal to an angle of 45 deg., and can be lengthened from its original length of 6 ft. to as much as 10 ft. by the addition of a bolted-on section to the frame.

Materials handling people took considerable interest in the Ramp Eliminator exhibited by Moto-Truc Co., Cleveland. The Eliminator consists of a platform with four legs hinged at both ends; a 1-hp. motor rotates the legs from their horizontal "down" position to a vertical "up" position, thus lifting the load. The Eliminator can be built in various sizes to lift a maximum of 12,000 lb. to a maximum height of 4 ft. In its motor-driven, low-lift, hand truck, this company has switched from foot-pump lift to power lift, an innovation that will be extended to the company's complete line of hand trucks. Also shown was a high-lift platform hand truck equipped with a 1-hp. motor lift and a 1½-hp. motor drive. It will life 4,000 lb. 66 in. in one minute.

A prefabricated, all steel belt conveyor was shown by the Patron Transmission Co., New York, as an example of the new line of Steelok conveyors which are available up to 48 in. in width and 100 ft. in length. Belt for the unit consists of interlocking steel plates mounted on ball bearing rollers operating on tracks running the length of the frame. The unit is motor driven. Another interesting item in the Patron exhibit was the so-called "accordion" gravity roller line. The frame of this unit is built on the lazy tongs principle which gives it its flexibility; it can be expanded, contracted or bent to any angle to suit varying conditions. It is 14 in. wide, 35 to 100 in.


long, and its telescoping legs give it a height range of 20 to 29 in.

According to the Wright-Hibbard Industrial Electric Truck Co., Phelps, N. Y., the new fork truck in the company's exhibit is one of the smallest and most compact electric trucks to be placed on the market. It features hydraulic brakes, tilt, life, drive.

## MATERIALS OF CONSTRUCTION

This section deals with special construction materials but, also, to an even greater extent, with equipment fabricated from special materials. If the emphasis is on the material, the equipment is treated here rather than in the sections covering various sorts of equipment.

*Metals*—Among pumps of special materials was the new line of Model 40 self-priming centrifugal pumps exhibited by the Duriron Co., Dayton, Ohio. These pumps are produced in a variety of corrosion resisting alloys including Duriron, Durimet and stainless steels. The smallest pump of the line, 1½ in., is of the close-coupled type.

A solid stainless steel (type 347) reactor was exhibited by Glascote Products, Inc., of Cleveland. This 25-gal. pilot plant vessel is equipped with a vertical motor-driven agitator, suitable stuffing box assembly, adjustable flattened tubular baffle (which also serves as a thermometer well), and a carbon steel jacket. It is designed to withstand 150 lb. internal pressure. Vessels of the same type can be supplied as desired in larger sizes. The company also displayed several alloy sleeves for agitator stuffing boxes, designed to protect glass-coated agitator shafts at the point where they pass through the stuffing box. Stainless steel and the Hastelloy alloys are common examples of materials used.

An important development in the fabrication of corrosion- and high-temperature-resisting alloys exhibited by Haynes Stellite Co., Kokomo, Ind., was indicated in a variety of precision castings in Stellite and Hastelloy, made by use of the lost wax or "investment" process. The method is now of considerable interest in the casting (rather than forging and machining) of turbine blading and other parts such as pump impellers. This company also pointed to the development of large sheets of Hastelloy D during the war which greatly facilitated the application of alloys of this series in the lining of large vessels.

Several advances among the nickel alloys were exhibited by International Nickel Co., New York. L-nickel is a new low-carbon material which is being employed in the concentration of caustic to anhydrous grade. The material has been used both as cladding for vessels and in tubular form. KR-Monel is a new free-machining grade of K-Monel which is heat-treatable. S-Monel has been employed recently as an overlay for plug cocks employed in the HF alkylation process in the petroleum industry, resisting the attack of HF in the presence of slight amounts of moisture far more successfully than the carbon steel which was initially used. A wartime development of interest in the application of nickel alloys, including Monel, nickel and Inconel, was the use of the lost wax process in making small precision castings with a tolerance of 0.002 in.

Most important of the new developments exhibited by Lead Lined Iron Pipe Co., Wakefield, Mass., and its associated companies, American Smelting & Refining Co. and Andrews Lead, is a new series of non-bonded lead-lined pipe, valves and fittings which, although unsuited to vacuum or temperatures much above 150 deg. F., is good for any pressure the pipe will stand and can be used in many applications at lower cost than homogeneous lined pipe. It is claimed that the installed cost is generally less than that of a simple lead line of equal size, considering the cost of supports and lead burning. The lining is inserted loose and expanded into the pipe or fitting by hydraulic pressure. This booth also contained samples of new prefabricated all-lead fittings, new homogeneous lined steel valves in which both the seat and the plug are renewable, and several extruded lead shapes developed during the war to speed rayon industry expansion by reducing field fabrication, including spinning machine gutters and linings.

Resisto Pipe & Valve Division of O. G. Kelley & Co., New York, had on exhibit a 6-in., all-lead centrifugal acid pump with an all-lead open impeller and lead casing. It was designed particularly for 10 percent sulphuric acid service in the rayon industry, delivering 100 g.p.m. at 100 ft. head or 900 g.p.m. at 40 ft. head. Also shown was a 16-in. wedge-gate valve with a solid lead wedge and valve body. This is believed to be the largest valve of its type on the market.

Numerous new products made from Worthite, its acid resisting alloy, were shown by Worthington Pump & Machinery Corp., Harrison, N. J. Included was a new centrifugal acid pump for higher head, gate valves in a wider range of sizes, a new needle valve, Worthite wire and hose nipples, and a broadened range of fittings.

*Non-Metals*—Developed by Ace Glass, Inc., Vineland, N. J., a new adapter for making metal-to-glass connections was exhibited. Consisting of a ball and socket joint with a specially developed clamp, this connection can be set at angles up to 45 deg. to aid the flexibility of any installation where glass pipes and metal pipes are used. The patented spring clamp which holds the ball and socket together is made of stainless steel as is the metal side of the connection. The joint is available in all standard pipe sizes from ¼ in. to 4 in. and has found use in connecting glass pipes to such process equipment as stills, evaporators, etc. Another similar joint is available for connecting quartz to glass or steel.

Rubber-lined venturi ball type valves were displayed for the first time by the American Hard Rubber Co., New York. This valve consists of a venturi-type body with a ball which is moved into the flowing stream and held in position by the pressure of the liquid up against a beveled valve seat. It may be adjusted to any desired position by a hand wheel and stem which holds the ball loosely. These valves are designed to afford negligible pressure drop and straight-line throttling characteristics. No packing, piston rings, snap rings, or springs are required. This valve is available in all standard sizes. Smaller sizes are made entirely of hard rubber, while larger sizes are rubber lined.

Several developments in plastics from a materials of construction standpoint were exhibited by Bakelite Corp., New York. The company's exhibit emphasized new developments in the preheating of plastic preforms by dielectric heating; a new alkali resistant plastic coating; and new vinyl tubing. Low-pressure laminates produced both from polyester styrenes and from phenolics were shown, having attained importance during the war in numerous applications where large size or the necessity for low mold cost required low molding pressure.

One important wartime development shown was "post forming" in which laminated material is partially cured in the flat, then formed into compound curved or similar objects in thermoplastic condition prior to final curing.

It is now possible to cut and fit glass pipe on the job by means of the new field joining equipment available from the Corning Glass Works, Corning, N. Y. In the past it was necessary to have the pipes cut to size and flanged in the shop. The equipment for doing this work in the field consists of two main parts. A hot wire cutter consisting of a nichrome wire loop heated by electricity is used to cut the pipe to desired length. It may be adjusted to handle a wide range of sizes of pipe and the temperature may be varied by changing the voltage. The second piece of equipment, consists of a ring burner using a gas-oxygen flame in which the end of the pipe is rotated, centrifugal action causing a bead or flange to form on the end of the pipe. At the present time only 2-in. pipe may be handled this way, but a complete range of sizes is planned.

Haveg 60 is the name of a new grade of plastic for equipment construction exhibited by Haveg Corp., Newark, Del. This material is said to be completely resistant to alkalis and to many solvents for which other grades of Haveg cannot be used. The material is tough, non-porous and rigid and can be used at boiling temperatures. It is not affected by rapid temperature changes, according to the manufacturer. In addition to its resistance to hot solutions of strong bases and to many solvents, the material has the same resistance to acids as Haveg Grade 41. It should not be used with hot oxidizing acids, with strong sodium hypochlorite, with aniline or pyridine. It is available in the form of tanks, towers and many other pieces of equipment following the same standards as regular Grade 41.

Several developments in corrosion resistant equipment, including both plastics and chemical stoneware, were found in the booth of Maurice A. Knight, Akron, Ohio. The company's new corrosion proof plastic, Permanite, is the base of the development. This plastic when combined with glass fiber reinforcement can be used as armoring for stoneware pipe to prevent breakage through thermal shock. Combined with glass fabric in a laminated structure, it was used in the construction of a high capacity HCl absorber equipped with Karbate tubes. The small unit shown, which is 13½ in. square inside and contains 40 cooling tubes, was said to have a capacity of 850 lb. of 34 percent acid per hour from 90 percent HCl gas. This company also exhibited a new double-pipe heat exchanger with Karbate inner tubes, the outer tube being either stoneware or Permanite.

Several new standardized pieces of equipment in Karbate, its impervious acid-resisting carbon, were exhibited in the booth of National Carbon Co., New York. Among these were valves, fittings, pumps and expansion joints. New heat exchangers included a tubular cooler consisting of a vertical assembly of horizontal pipes supported at the ends in headers, with water distributed over the pipes from an overhead trough. Another new heat exchanger is a plate type, for suspension in a tank. The company's improved method for Karbate tower construction was shown, designed to take advantage of the high compressive strength of the material. The tower sections are drawn together and made tight by a series of spring-loaded metal tie rods.

Owens-Corning Fiberglas Corp., Toledo, Ohio, presented recent developments in the production of superfine glass fibers in diameters of less than 0.00009 in., as contrasted with standard glass fiber diameters ranging from 0.00023 to 0.00038 in. Fibers are being twisted and plied to a yarn that is soft to the touch and can be used for decorative, combination, and coated fibers, as well as in life preservers and insulation.

One of the most popular substitutions for critical metals during the war was the use of Saran tubing for a wide variety of purposes. To meet this need, Parker Appliance Co., Cleveland, developed and exhibited factory prefabricated Saran pipe and fittings in sizes from ⅛ up to 2 in. The pipe ends are flanged and the joint requires no gasket. The fittings are machined from methyl methacrylate, employing a square thread, on account of the need for extremely close tolerances.

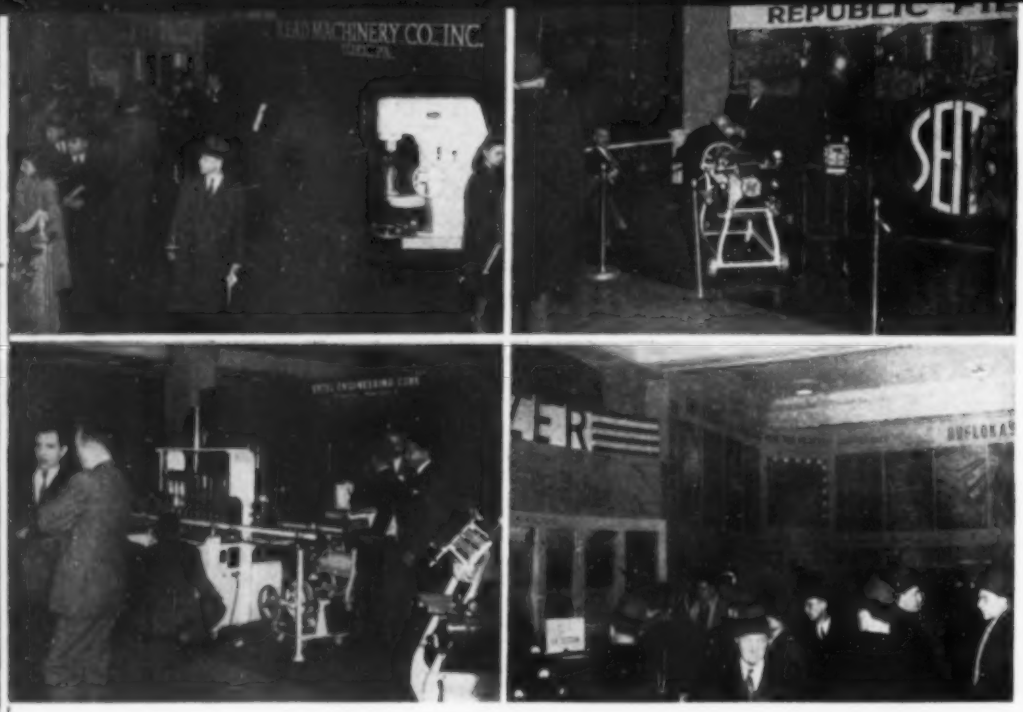
Several developments in glass-lined equipment were exhibited by the Pfaudler Co., Rochester, N. Y. Among them was the novel idea of facilitating gaging the contents of a mixing or reaction vessel by making a measuring stick of the agitator shaft. The markings are applied to the shaft, using a pigment-free white glass in the form of inch and foot marks which are clearly visible against the cobalt-blue glass coating on the shaft. The company showed a new glass-lined pop safety valve and a flush outlet valve for kettle bottoms as well as a quick-opening flush valve for bottom outlets. In each case the seat and plug were of porcelain although the remainder of the apparatus in contact with the material handled was glass-lined.

A variety of developments in special construction materials was exhibited by U. S. Stoneware Co., Akron, Ohio. These included improvements both in chemical stoneware and in plastics. Among the former was a new suction filter of stoneware employing a "Filterstone" plate sealed at the edges and then ground to a watertight joint. A 40 percent increase in filtering rate is claimed as compared with ordinary stoneware nutsch filters. An improved joint for bell and spigot stoneware pipe, known as the Tylox coupling, was exhibited. Here a peripherally ribbed sleeve of rubber or suitable plastic is factory cemented into the bell end of the pipe. When the pipe is assembled, the spigot end is pushed into the sleeve, forming a flexible and permanent joint.

Among developments in plastic construction materials shown by this company was an acid resisting coating for metals, known as Acikote, which is a phenolic resin material for baking on to produce resistance to all but highly oxidizing acids and to all solvents except esters or chlorinated hydrocarbons. A new method for assembling joints in Tygon tubing was exhibited, consisting in a special modification of a soldering iron used for flanging the tubing, together with a metal coupling that is claimed to be tight against 75 lb. pressure when screwed up with the fingers alone. Impregnating a resin of the Duralon type into a porous type of low-fired chemical stoneware, this company developed Ceralon, for which exceptionally high resistance against heat shock is claimed.

## MIXING AND AGITATING

For the mixing of heavy, dough-like materials on a small laboratory scale, Baker Perkins Co., Saginaw, Mich., showed its new Micro Mixer, a double-arm dough type mixer in miniature, with a capacity of 2 cu. in. of material. Like its usual pro-



duction and laboratory size relatives, the little mixer is equipped for water cooling or heating of the mixer chamber. The latter tilts for discharge and is provided with interchangeable mixing blades in several designs for different classes of work.

Bramley Machinery Corp., New York, introduced its Beken duplex mixer which uses what is said to be a new principle in mixing machines. The two peculiarly shaped blades intermesh and revolve at different speeds, one twice the other. The machine has been used effectively in mixing asbestos fibers into pitch, and with siliceous clays wetted with a moisture content as low as 8 percent. An outstanding feature of the mixer, according to a company representative, is that it prevents balling.

Tank agitators manufactured by the Eastern Engineering Co., New Haven, Conn., have been improved by the use of two new seals. The twin rotary seal combines the features of a mechanical seal and a pressure stuffing box. Mechanical seals at each end of the bearing chamber hold the bearing lubricant under a pressure greater than that in the tank. Pressure is maintained by an air chamber, fitted with a pressure gage which indicates any seal damage or other functional failure. Backed with internal pressure there is no possibility of damage from materials in the tank. The mechanical rotary seal consists of a stainless steel sealing surface, rotating against a stationary carbon sealing ring which is held in position by a metal spring. A positive seal against leakage of gas or fluids is claimed in the absence of corrosive liquids. Both of these seals are available on the side entering and vertical models of mixers manufactured by this company.

Combining slow-moving paddles and side-wall scrapers with the turbine feature of the high-speed Homo-Mixer, Eppenbach, Inc., Long Island City, N. Y., now manufactures a single- and double-acting paddle mixer. The paddles and scrapers keep the entire batch of material in constant motion until all the material is gradually worked through the high-speed turbine mixer. Scraper agitation prevents the batch from "setting up" around the walls of the tank. This combination of mixing devices is designed to promote and complete chemical reactions requiring a time-lapse, in capacities of 5 to 250 gal.

Used for reactivating, agitating and blending finely divided material stored in bins or silos, a new type of aeration unit is now available from the Fuller Co., Catasauqua, Pa. It consists of a cast-iron receptacle, the top of which is fitted with a porous element. The propulsion medium, which can be either compressed air or gas, is admitted to the side of the receptacle by pipe connection under relatively low pressure, and is passed through the pores of the face element. One or more elements may be installed in the bottom or sides of hoppers or silos and are useful in preventing the contents of the hopper from arching or hanging up when discharging.

One novel mixing device at the Exposition was the Type H vibrating mixer exhibited by Jeffrey Mfg. Co., Columbus, Ohio. The device consists of a length of vibrating conveyor trough containing a number of shelves which slope upward slightly in the direction of material motion. The higher ends of these shelves are toothed so that material passing over the teeth is repeatedly cut and divided, producing a thorough mechanical mixture.

Mixing Equipment Co., Rochester, N. Y., displayed a new type vertical agitator drive, designed to cut down the head room required when the motor and reducer assembly are directly connected to the vertical agitator shaft. In the new assembly the motor is installed horizontally and the reducing gear is sandwiched between the two bearings on the vertical agitator shaft.

A pelletizing machine, which has been used for a few years in the carbon black industry, was shown by the James Russell Engineering Works, Boston, which is introducing the machine under a licensing arrangement for applications other than on carbon black. Chrome greens and yellows are examples. The machine consists of a series of concentric circular "squirrel cages." Alternate cages rotate as a unit about a vertical axis; the other cages are stationary. Material to be processed is apparently pelletized by a rolling, churning motion. Units of various sizes can be built; one consisting of five cages (two rotors and three baffles), handling material with an initial density of 12 lb. per cu. ft., will pelletized 10,000 lb. in a 24-hour day, compacting it in the process to a density of about 20 lb. per cu. ft. The over-all dimensions of such a machine are 42 in. diameter and 36 in. height, operated on a 15-hp. motor.

Agitation and heating of liquids in tanks may be accomplished by using a new sparger nozzle exhibited by Schutte & Koerting Co., Philadelphia. This nozzle consists essentially of a jet with a venturi throat which not only provides efficient heating with direct steam, but insures uniform circulation of liquid. Noise and vibration are claimed to be eliminated.

A standardized mixing arrangement for water treatment was shown by Worthington Pump & Machinery Corp., Harrison, N. J. Here agitation was accomplished by recirculating the tank contents through a small centrifugal pump. Automatic control of the rate of discharge from the tank was accomplished by a swing draw-off pipe.

## POWER TRANSMISSION

In the exhibit of Cleveland Worm & Gear Co., Cleveland, was the company's "Speedaire," a fan-cooled worm-gear speed reducing unit which provides its own air cooling system. An exhaust fan draws air at high velocity across finned surfaces, effectively scouring the ends, sides and base of the oil reservoir. The unit is said to deliver up to twice the capacity obtained from a standard worm-type reducer of equal size without forced cooling.

Falk Corp., Milwaukee, Wis., had on display several of its newest (Type F) Steelflex couplings for parallel or angular misalignment of shafts. It is so designed that a large number of flexible steel strips carry the torque through shear loading. The coupling is available in numerous sizes up to 100 hp.

Compact construction was featured in the new totally inclosed Tri-clad motor exhibited by General Electric Co., Schenectady, N. Y. It is said to be suitable for corrosive atmospheres as well as for outdoor use without extra protection, and for dusty locations.



The motor is built also in explosion-proof and dust-explosion-proof constructions. It is fan-cooled, of double-shell cast iron type, and is considerably more compact than earlier motors of this class.

A new centrifugal clutch that can be used to accelerate heavy loads with a squirrel cage motor instead of the wound rotor type generally required for such loads, was shown by the Hardinge Co., York, Pa. The BLM Auto-Centri clutch was previously manufactured for some ten years in Canada. It consists of a driving member carying lugs between which are a number of weighted members carrying brake lining on their outer peripheries. A driven member incloses the members already mentioned and serves to accelerate the load after the motor has come up to speed, as the weighted members are forced outward by centrifugal force.

Reliance Electric & Engineering Co., Cleveland, featured two types of self-contained, variable-speed drive units for connection to a.c. power sources. Both represented the latest models of the company's "packaged" units. The first type is essentially a motor-generator set with voltage control on the d.c. side; it is available in a variety of sizes to furnish outputs from 1 to 200 hp. The second type is based on vacuum tube rectification and d.c. voltage control; it is available in sizes from 1 to 5 hp. for speed ratios of 8-to-1, 12-to-1, or 16-to-1. The company was also showing a generator-type tachometer which is made in seven standard speed ranges from 0-750 to 0-5,000 r.p.m.

Not entirely new, but shown for the first time at the Chemical Show was a novel speed changer of the infinitely variable type, produced by Worthington Pump & Machinery Corp., Harrison, N. J. The unit, now produced in sizes from ¼ to 3 hp. output, will later be available in larger sizes. It produces any desired speed from ¼ to twice the motor speed, using a new arrangement of the well known variable-diameter cone-pulley and V-belt idea. Two belts and four pulleys are used, the novel arrangement being in the fact that there are two reductions in series.

## SOLIDS SEPARATION

Two new applications for Alnico permanent magnets were exhibited by Eriez Manufacturing Co., Erie, Pa., one a self-cleaning permanent magnet to be installed over a belt conveyor, and the other a magnetic trap for insertion in slurry or pulp pipelines. The first is available in two sizes, namely, 2 or 3½ in. pull, that is, the distance through which it will lift tramp iron from the conveyor. In the pipeline trap for non-filterable slurries, the process fluid is thrown by a baffle against the magnet plate; the magnet is not self-cleaning but is designed for convenient intermittent manual cleaning. The trap is made of stainless steel and is available to fit 2, 3, and 4 in. pipelines.

A unique multiple-sieve, high-speed gyratory screener was exhibited by the Great Western Manufacturing Co., Leavenworth, Kansas. The important feature of this device is that the screens are interchangeable. Up to 10 screens can be used, in all standard mesh sizes from 2 to 325 mesh, and in any combination desired. Thus a single piece of equipment can be used interchangeably for various materials, merely by selecting the best combination for a given job.

Two new packaged type dust collecting units were exhibited by Pangborn Corp., Hagerstown, Md. The type CK consists of a cyclone collector for removal of most of the dust from the air stream, topped by a filter unit for collection of the remaining dust. This unit is produced in sizes of 1,000, 2,000 and 3,000 c.f.m. of air and is equipped with improved motor-operated shaking means. A similar unit which, however, omits the cyclone portion but includes a hopper bottom, is known as type CL and is available in six sizes from 180 to 820 sq. ft. of filter surface.

Radio Corp. of America, Camden, N. J., exhibited a novel metal (any metal) detector, designed for automatic detection of metal particles in nor-metallic materials such as foods, rubber, plastics or the like. The product being inspected is conveyed by belt or other means through the inspection aperture; here it is screened by a high frequency electro-magnetic field. If metal is present, it causes distortion of the field which is detected and amplified by an electron tube to actuate a signalling or ejection device.

Further development in its line of electrostatic separators was emphasized by Ritter Products Co., Rochester, N. Y. Similar in principal to the separators shown at the 1943 Show, construction is now heavier and means for setting the splitter blades have been made completely foolproof. New methods for pre-conditioning various kinds of feeds have been investigated and are said to have resulted in greatly improved separations in some instances.

Claude B. Schneible Co., Detroit, displayed a new machine called the Velocitrap. This machine separates dry matter out of the air with a very low pressure loss. Through the use of a right-angle vertical turn in an air duct, centrifugal force carries the dry particles out of the air stream and into a pocket where the dry matter is collected. The unit may be used in connection with a dust removal system when total removal of the dust particles is required, or it may be used alone when complete removal of all dust is not necessary.

An improved type of air separator of extremely sensitive characteristics was exhibited for the first time for Sutton, Steele & Steele, Dallas, Texas, by Separations Engineering Corp., New York. Known as the Controllaire, the device is intended for separations at about —40 fesh for higher density materials, such as ores, or at about —8 mesh for lighter materials such as seeds. The unit combines a vertical four-stage separating tube in which the actual cleaning takes place, and a cyclone which collects the lighter components. The mesh at which separation takes place is controlled by the rate of air flow drawn into the bottom of the separating tube. Several fractions of different size can be separated by several passes through the apparatus, using different rates of air flow. With sized material, the unit can be used for separation on a gravity basis.

## PROCESS EQUIPMENT

Dehumidifying equipment of the type now being used by the Navy in laying up vessels which have been carefully sealed to minimize the introduction of moist air were shown in the booths of two exhibitors. Aluminum Co. of America showed the acti-

vated alumina type produced by Pittsburgh Lectrodryer Corp., Pittsburgh, Pa., while Davison Chemical Corp., Baltimore, Md., showed the silica gel type built by Cargocaire Engineering Corp., New York. Both types are self contained units, differing in construction details and in the desiccant used, but similar in that each employs two drying towers, one of which is regenerated while the other is reducing the moisture content of the air within the ship to maintain 30 percent relative humidity or less. Electric heat is used for regeneration and the cycling is accomplished automatically, without attendance. Both types are said to have been designed for new low operating cost that offers interesting possibilities also for industrial use.

New catalyst carriers were shown by a number of exhibitors, including activated alumina, by Aluminum Co. of America, and silica gel, by Davison Chemical Co. The Darco Co., New York, exhibited carriers of activated carbon, while carriers of diatomaceous silica were being displayed by the Dicalite Co., New York. A new carrier exhibited in the last named booth is being used in starch conversion and in petroleum. Its structure is harder than diatomaceous silicas for most purposes and it is capable of withstanding a temperature of 3,200 deg. F.

Artisan Metal Products, Inc., Boston, introduced a continuous vacuum solvent stripper designed to accomplish separation completely and continuously of a volatile liquid from one which is substantially nonvolatile. The liquid to be concentrated enters through the feed connection to the top concentrating tray. This tray, and two subsequent trays, can be heated by any of various heating mediums. Liquid boils on this tray while flowing concentrically around the central vapor riser, liberating some of the lower volatile materials and thereby increasing the concentration of the solids or higher volatiles. The temperature gradient between heating medium and the liquid may be controlled by varying the heating medium pressures on the different trays. Installations using steam under vacuum conditions for evaporating sensitive materials at low temperatures are claimed to have given very satisfactory results.

Now available from the Barnstead Still & Sterilizer Co., Boston, a new double-action type of water demineralizer employs two cation resin beds and two anion resin beds for effective ion exchange purification of water. The water flows through alternate cation and anion resin beds in series to secure high efficiency and high water purity. This four-bed demineralizing unit may be used nearly three times as long before regeneration as the simple two-bed type. It is available in capacities through the whole range of 3 to 1,000 g.p.h. Standard two-bed water demineralizers are also made by this company, in capacities up to 1,000 g.p.h.

In a booth devoted to a considerable extent to flowsheets, the Blaw Knox Co., Pittsburgh, showed two new process flowsheets, one the Emersol process for continuous solvent separation of fatty acids, developed by Emery Industries; and the other a batch or continuous non-catalytic fat splitting process. The Emersol process separates mixtures of stearic and oleic acids by crystallization in an alcohol solvent, followed by distillation to recover the two components free of solvent. Being without the usual pressing and repressing operations, the process needs little labor. The fat splitting process makes use of hydrolysis at temperatures above 500 deg. F., and high pressure, to yield free fatty acids and glycerine, the latter being recovered by distillation. Dowtherm is the heating medium.

Similar in principle to its commercial spray dryers is the laboratory model shown by Bowen Engineering, Inc., Garwood, N. J. Standing on a 3 x 6-ft. table, the unit can reduce a quart or two of almost any aqueous solution or slurry to a dry powder within a few seconds. The 50,000 r.p.m. spray wheel is driven by a small air turbine. Temperature-controlled hot air is introduced through a vaned inlet head surrounding the spray wheel.

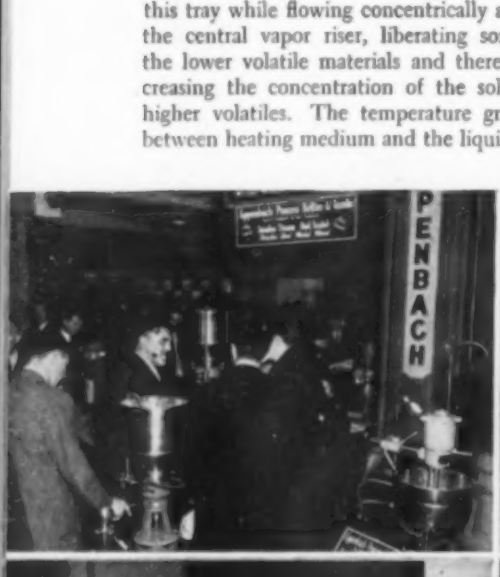
What may some day be a new tool of the chemical engineer, the use of supersonic vibrations in the production of emulsions and the acceleration of reactions, can now be investigated on a laboratory scale employing the Ultra-Sonorator produced by Crystal Research Laboratories, Hartford, Conn., and exhibited at the exposition by Fisher Scientific Co. and Eimer & Amend, New York. The new instrument, which is approximately the size of a good-sized radio, operates on any 110 volt 50-60 cycle line and produces over 500 watts of high frequency energy. Four frequencies are possible, 100, 400, 700 and 1,000 kilocycles per second, these frequencies being controlled by ground quartz crystals. Other frequencies can be secured by purchase of relatively inexpensive additional crystals. In use, experimental material is immersed in a bath of heavy oil which then transmits the supersonic energy to the material from the crystal.

Indicative of the developing trend toward the use of ion-exchange processes both for water purification and for other purposes was the exhibit of the Dorr Co., New York, which embraced both a new model de-ionization apparatus and a flow sheet display demonstrating how the process is used in the purification of sugar juices. The improved de-ionization unit, when employed in the de-mineralization of water, is claimed to produce water of substantially distilled quality at costs ranging from 2 to 20 cents per 1,000 gal. The system uses two stages, the first stage passing the raw water over a bed of exchange material which removes calcium and magnesium constituents as well as sodium and other metallic ions, while the second stage is an anion exchanger which absorbs the acids resulting from the initial step, delivering water of final desired quality.

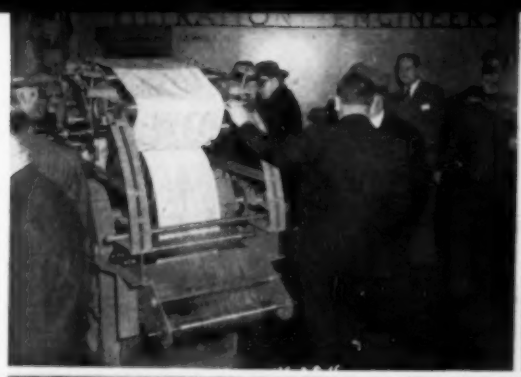
The same concern exhibited a flow sheet indicating the operating principle of its Fluo-Solids process for treating solid materials in gaseous suspension.

A scale model of a multiple-effect evaporator embodying a number of improvements was shown by the Process Equipment Division of General American Transportation Corp., Chicago, Ill. Essentially, this is a streamlined unit with internal separators built into the shell of each body. Other similar equipment ordinarily external to the shell is also built into the body, providing a completely streamlined unit. Another feature of this model was that each evaporator body is individually supported by four legs requiring no superstructure or other support.

Latest among developments in tower packings was a new packing ring exhibited by General Ceramics & Steatite Corp., Keasbey, N. J. The new Frischer ring is similar to a Raschig ring, except that it is somewhat longer and its two ends, which are parallel,









are cut at an angle to the axis of the cylinder. Conventional rings have a tendency to settle in regular layers and come to rest in positions where the walls of adjacent rings mutually obstruct their openings. The new ring has been designed to overcome such objections since it is in unstable equilibrium when placed with the axis horizontal, thus tending to tip over. Furthermore, the tendency of the rings is for a group of rings, when dumped, to dispose themselves in such a way that one ring enters to an appreciable depth into the opening of an adjacent ring.

Exhibited by Radio Corp. of America, Camden, N. J., was a "packaged" vacuum unit consisting of a bell jar containing six pairs of 50 amp. terminals, built-in power supply and instrumentation, a mechanical forepump and an oil diffusion pump for evacuation. The outstanding advantage claimed for the unit is the valving mechanism which permits most of the air in the vacuum chamber to be removed without drawing air through the diffusion pump. After a pressure of about 100 microns has been reached with the forepump, the diffusion pump is connected to reduce the pressure to from 0.5 to 0.1 microns. The arrangement results in a reduction of the pumping time to 7 min. for an 18 in. chamber or a reduction of 10 min. for a 29 in. chamber.

RCA also exhibited the latest model (Type EMU) of its electron microscope in which some electrical and mechanical refinements have been incorporated, principally to provide greater operating convenience.

## OTHER EQUIPMENT

*Paper Machinery*—Paper & Industrial Appliances, Inc., New York, displayed the Evans' Rotabelt suction unit for wires, felt, and all suction purposes on paper and board machines. The unit's rubber belt is not mechanically driven but is rotated by the wire or felt on the paper machine, conforming to the same speed. This is said to result in efficient water removal with a great increase of wire or felt life. The Rotabelt was developed to meet a need for a suction box that would remove greater quantities of water without sacrifice of wire life, especially at higher machine speeds. It transfers the wear from the fourdrinier wire to a perforated rubber belt which revolves around two rolls, passing over a wide, deep, stationary suction box.

For the paper making industry, Poirier Control Co., Waterville, Me., showed its so-called syphon header, a device to be attached to fourdrinier suction boxes and designed to maintain constant suction in spite of fluctuations in the amount of water which must be carried away. The header consists of a cast iron box with a small mechanical evacuating pump at one end for priming, a large flanged opening at the other end for connection to the suction box, and seven threaded holes in the bottom for the attachment of water legs. Inside the box, low baffles separate the water leg openings from one another so that water entering the box from the suction box does not enter, for example, the fourth leg until the first, second and third are operating at capacity. By using seven small legs instead of one large one, the velocity of the downflowing water is always sufficient to entrain the air sucked through the paper, thus maintaining vacuum no matter how much water the sheet may carry.

*Presses*—The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, showed a model of its latest horizontal injection molding press. Model 350-H-16 is all-hydraulic in operation and, as compared to earlier models, represents an increase in size, permitting the injection of 16 ounces of plastic per cycle. The machine has a plasticizing capacity of 100 lb. per hour and a mold clamp capacity of 350 tons. The available space for placing molds is 20 in. wide, 30 in. high, and 32 in. long. Injection pressure on the plastic material is 20,000 lb. per sq. in.

A semi-automatic press for transfer molding was featured in the booth of the F. J. Stokes Machine Co., Philadelphia. The press is similar to the company's Standard line of compression molding presses, except that a second hydraulic cylinder is provided above the head of the press to actuate the upper platen. The lower platen, actuated by a hydraulic press through toggles, is used to close the mold, while the upper cylinder applies molding pressure. All operations except loading and unloading are accomplished automatically by a sequence controller mounted in the same cabinet that contains the dual hydraulic pressure system. The press can readily be used also for compression molding by cutting out the upper hydraulic cylinder.

*Safety Equipment*—Several new safety appliances appeared in the booth of Industrial Products Co., Philadelphia. One, a lightweight asbestos cloth called Asbestone, represents a refinement of the weave customarily found in asbestos cloth and is projected for use in clothing and hoods. The company also took occasion to introduce a new line of full vision respirator hoods; a one-piece (including gauntlet) neoprene suit, a combination gas mask and over-the-shoulder splash hood and new synthetic rubber gloves.

A novel type of oxygen breathing apparatus which is completely independent of surrounding atmospheres was shown by the Mine Safety Appliance Co., Pittsburgh. It consists of a gas mask in which the exhaled air is breathed into the canister, where its moisture causes liberation of oxygen. Carbon dioxide is taken up by the chemicals in the canister. The active material in the canister consists of a metallic tetra-oxide which reacts with water to liberate oxygen. Should any excess oxygen be produced, it is taken care of in a rubber breathing bag which is an integral part of the apparatus. Prior to use, the canister is completely sealed until a screw plunger in the bottom of the kit is tightened up to puncture the canister seal, allowing the exhaled air to enter. This "Chemox" self-generating breathing apparatus is said to insure one hour's protection in unbreathable air. It weighs only 13½ lb. complete.

*Containers*—A complete line of fiber drums in capacities from 1 to 60 gal. was shown by the Carpenter Container Corp., Brooklyn, N. Y. These drums use lock-rim-no-nail heads. They may be water and grease-proof coated on the inside, depending on the specific applications.

Among its seamless steel containers for compressed gases, the exhibit of Pressed Steel Tank Co., Milwaukee, Wis., included examples of new small containers in a wide range of sizes for a variety of pressure conditions.

# PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

### ROTARY KNIFE CHOPPER

UNIFORM granulation of plastic scrap to homogeneous granules for uniform mold flow is claimed for the new American KC rotary knife chopper recently announced by the American Pulverizer Co., 1219 Macklind Ave., St. Louis 10, Mo. The machine is suitable for the reduction of a variety of thermoplastics, even if the product softens at temperatures as low as 40 to 50 deg. C. It employs three adjustable hardened tool steel cutter blades affixed to a heavy balanced rotor which rotates past stationary knives in a reduction chamber. With a capacity of 200 to 400 lb. per hr., the machine occupies a floor space of only 36 x 72 in.

### GAGE GLASS PROTECTOR

KLEERVU is the name of a new gage glass protector introduced by the Wright-Austin Co., 356 West Woodbridge St., Detroit 26, Mich. The protector consists of two parts, a metal frame with four holding springs and a ¼ in. thick curved transparent cover of Nuglas. Although protection is claimed to be complete, it is also maintained that there is no loss of visibility, and no blind spots. Protectors of this type are now available in any desired length for tubular gage glasses.

### TREAD-LOCK WHEEL

DEVELOPED as a tail wheel for Navy aircraft, the Grizzly Tread-Lock wheel produced by the Thermoid Grizzly Wheel Sales Div. of Thermoid Co., Chicago, Ill., is now available for industrial use for hand and floor trucks and similar purposes. The wheel is made in four standard sizes from 6 to 12 in. to fit standard axles, while special sizes can be secured to order. These wheels are provided with precision bearings, lubricated for life. Another feature is the use of "breather holes" in the wheel casting, which allow the rubber to expand under pressure, and contract when the pressure is relieved. The tread is said to be tough and cut resistant, while it is reported that in Naval service such wheels outlasted previous types of tail wheels as much as 100 times.

New Tread-Lock wheel

Two-part gage glass protector

Portable stack gas analyzer

### CRANE BRAKE CONTROL

A RECENT development made in connection with the Type HM crane-bridge brake manufactured by Wagner Electric Corp., 6445 Plymouth Ave., St. Louis 14, Mo., is the new brake control unit designed to provide automatic "cushioned" emergency stops when the power fails or the crane runs beyond safe limits on the runway. The unit permits free use of the foot controlled hydraulic brake for service stops and also holds the parking brake mechanism ready for an emergency stop or for parking. In any event, the valve of the control unit applies the brake at a predetermined rate to bring the crane and its load to a quick, smooth stop without undue swinging of the suspended load.

### STACK GAS ANALYZER

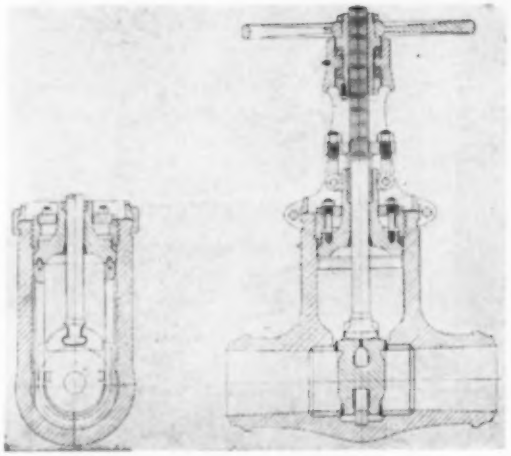
MEASUREMENTS of carbon dioxide content, temperature and draft are combined in a single portable instrument known as the Stack-O-Meter recently developed by the Davis Emergency Equipment Co., 45 Halleck St., Newark 4, N. J. Carbon dioxide readings are obtained from gas samples collected through a hand aspirator bulb. Stack temperatures, read on the same dial, are obtained electrically from a thermocouple mounted in the gas sampling tube. Draft measurements are obtained through a separate tube but read on the same meter. Since gas analysis is accomplished by the thermal conductivity method, the instrument is entirely electrical in operation and requires only the occasional replacement of standard flashlight type batteries.

### WATER EJECTOR

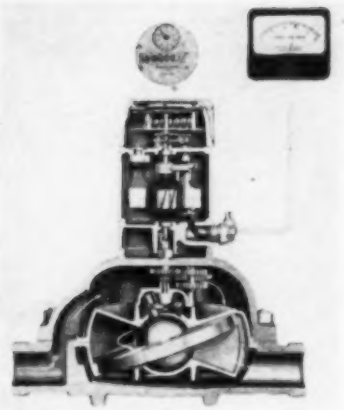
DESIGNED to remove water automatically from compressed air systems, the N. P. automatic water ejector has recently been announced by National Pneumatic Co., 420 Lexington Ave., New York 17, N. Y. The device is claimed to do away with frequent manual draining of water separators and air lines. Also it is said to save air since the ejector never connects the compressed air system to the atmosphere. The device can be installed in any location where air line water is collected. Three connections are necessary, one to the bottom of the water collector, another to a drain, and the third to an air line that is repeatedly charged and discharged, such as the unloader line of an air compressor. At 100 lb. pressure, 30 pressure cycles will discharge 1 qt. of water.

### SUPER-LARGE FRACTIONATING TOWER

**Claimed to be the largest shop-fabricated steel vessel ever made, this fractionating column built by A. O. Smith Corp., Milwaukee 1, Wis., is so large that if necessary it could have been used as a tunnel for the railroad locomotive and flat cars that moved it. Too large for the railroad to ship to Standard Oil Co. of Indiana at Whiting, it was shipped four miles by rail to the lake front where a barge received it and carried it to its destination. To permit the four-mile rail haul, all traffic had to be stopped and considerable track-side equipment had to be dismantled. The vessel is 106 ft. 8 in. long, 16 ft. in diameter, and has a wall thickness of ¾ in., with a 7/64 in. stainless steel liner. It weighs 320,500 lb.**



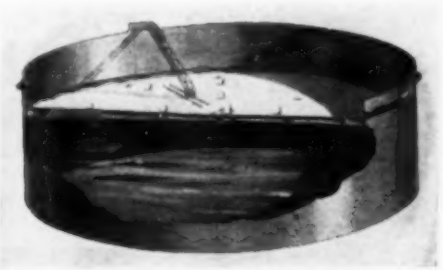
Details of new pressure-sealed steam valve



Indicating and totalizing flow meter

Centrifugal type air separator

Quantometer spectro-chemical analyzer



Improved floating roof for volatile liquid tanks


Adjustable calibrated temperature control

## PRESSURE SEAL VALVE

FOR HIGH-PRESSURE, high-temperature steam service, primarily in the 900 and 1,500 lb. pressure classes, the Crane Co., 836 South Michigan Ave., Chicago 5, Ill., has developed a new line of globe, angle and automatic stop-check valves incorporating novel departures from conventional practice. The pressure-seal bonnet is of a type similar to that used on pressure vessel covers, which is automatically sealed by the internal pressure. Since the bonnet joint can readily be taken apart and reassembled, inspection is facilitated. Weight reduction of 40 to 60 percent, depending on size, has been accomplished in comparison with conventional bolted-bonnet valves. The design is clean, facilitating insulation. A new disk design is used, featuring built-in flexibility, while the body rings are of a new type to permit straightline flow and minimum friction.

## AUTOMATIC ANALYZER

AUTOMATIC quantitative chemical analysis for as many as 11 elements in alloys, chemicals and other materials can be accomplished in less than one minute, it is claimed, by the Quantometer recently announced by Applied Research Laboratories, 4336 San Fernando Road, Glendale, Calif., and the Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich. The device employs spectrochemical analysis, the results appearing directly as percentage composition on a series of counters, one for each element being determined. Three units are employed, a source unit providing a powerful spark, a spectrometer, and a recording console. There are 12 receivers, arranged to record light from as many spectrum lines. Thus photographing the spectrum is eliminated and high speed is achieved.

## INDICATING FLOW METER

INDICATING the flow rate and totalizing the flow of a variety of liquids is accomplished by a new volumetric type meter known as the Veriflow that has been announced by Hays Corp., Michigan City, Ind. The volumetric flow measuring device is of the nutating disk type, similar to that customarily used in water meters. However, in addition to the usual totalizing register, the meter incorporates a small generator which can be connected by wiring to a remote flow rate indicator or recorder. Among the materials that can be handled are oil, water and a variety of chemicals. Several meters may be connected so as to show the total rate of flow to all meters; they may be connected to show the difference in rate of flow through two meters; or connected to show the ratio of flow rate in two lines.

## TEMPERATURE CONTROL

SEVERAL important advantages are claimed for new line of adjustable, calibrated Cam-Stat temperature controls recently announced by Paul Henry Co., 2037 So. La Cienga St., Los Angeles 34, Calif. These instruments are said to permit precise dial selection of the temperature control point, with uniformity of dial accuracy in all units. Almost no space is required for mounting and the price is substantially that of other thermostats without a calibrating dial.

A wide choice of adjustable ranges is available between −50 and +600 deg. F. with differentials as low as 1 deg. F. The unit may be clamped to the side of a tank or the element immersed in the liquid whose temperature is being controlled. Double-break, snap-action contacts rated at 12 amp. at 115 volts a.c. are available in various switch action arrangements.

## FLOATING ROOF

IMPROVEMENTS in the Horton floating roof for tanks storing volatile liquids have been announced by the Chicago Bridge & Iron Co., 332 So. Michigan Ave., Chicago 4, Ill. The improved design employs a double deck construction which insulates the liquid and thus eliminates most boiling, extending the range of products that can be stored in tanks of this type. The lower deck is sloped upward toward the center to vent all air, while the upper deck slopes toward a drain located at the center.

## PROTECTIVE APRON

A NEW apron, known as the Gardwell Oil-Chem, has been developed by the Safety Clothing & Equipment Co., 7016 Euclid Ave., Cleveland 3, Ohio. Intended for protection of clothing against oils, acids and chemicals, the apron is made of a pliable, transparent plastic material that is 0.006 to 0.008 in. thick and extremely light in weight. It is claimed that the apron is durable and long wearing. It is available in both bib and waist styles, in a wide range of sizes.

## AIR SEPARATOR

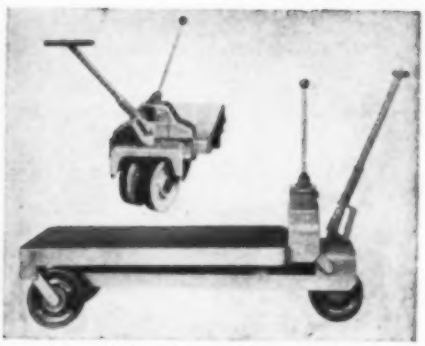
REMOVAL of moisture, oil, scale and other contaminants from compressed air is the function of the Airfuge separator developed by The Swartwout Co., 18511 Euclid Ave.,

Cleveland 12, Ohio. Utilizing centrifugal force to effect separation, it is claimed that repeated tests have shown the delivered air to be 99 percent, or more, free of contamination. Unwanted substances are thrown out of the air stream and drain to the bottom where an integral float-operated trap releases condensate automatically. Seven sizes, ranging from ¾ to 2½ in. pipe connection size, are available.

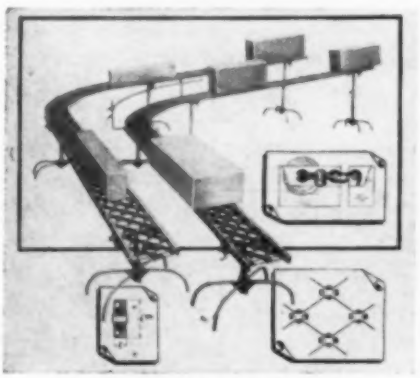
### TRUCK LOADER

UNIT package loads weighing up to 1,000 lb. can be lifted, carried, stacked and tiered in motor trucks and other confined spaces by means of the new Trucloader fork truck recently announced by the Clark Tructractor Division of Clark Equipment Co., Battle Creek, Mich. The unit is maneuverable in narrow aisles and has an exceptionally small turning radius of 57 in., enabling it to run safely in and out of trucks and trailers and on to elevators which cannot handle heavier loads. According to the manufacturer, a saving of more than 75 percent of the manhours required for loading and unloading trucks can be accomplished through the use of this equipment together with the elimination of up to 90 percent of the accidents and injuries resulting from manual handling.

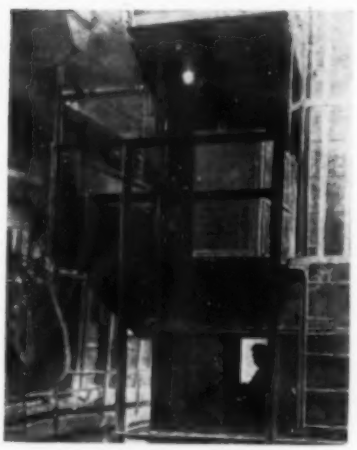
1,000 lb. truck-loading fork truck



Hydraulic skid lift truck



Improved portable roller conveyor



Cooling unit on crane cab

### PORTABLE CONVEYOR

WHAT is said to be the lightest steel conveyor available (each 10-ft. length weighing only 58 lb.), is the Load-Veyor recently developed by Market Forge Co., Everett 49, Mass. This gravity roller conveyor, employing 1⅝ in. diameter ball bearing rollers supported in a rigid grid-like construction, is reversible so that one side can be used for large packages, while the reverse side is used for small packages. In the latter case the side members act as guide rails. These conveyors are also produced in aluminum or stainless steel, while a complete line of accessories including curves, stands, package retarders and package stops is available.

### LIFT TRUCK

DEVELOPMENT of a standardized line of lift trucks to which the name Load-Lift has been given has been announced by Market Forge Co., Everett 49, Mass. Made in 3,000 and 5,000 lb. sizes, the truck is of the skid-lift type, employing a double acting hydraulic lifter divorced from the pulling handle so as to avoid possible accidents. All wheels are equipped with life-time-lubricated, sealed ball-bearing wheels of steel, rather than cast iron, although plastic and rubber wheels are also available.

### IMPROVED GASKET

DEVELOPED during the war as a substitute for rubber and other critical gasketing materials, Chrome Lock gasketing is now available from Department A-96 of the Products Research Co., 634 South Western Ave., Los Angeles 5, Calif. Generally employed by the shipbuilding industry during the war in ventilation and forced draft blower systems of naval and commercial vessels, the material is now offered industrially for many uses, owing to its flame resistance, fuel resistance, rust inhibiting character and other advantages that include ease of handling. In connection with the latter point, this is claimed to be the only gasket that adheres to metal without cementing the gasket to the flange, thus facilitating installation and assuring a positive seal. Two types are available with the adhesive back, and two types without, both packed in rolls and slit rolls.

### CRANE CAB COOLER

FOR THE comfort of operators of cranes installed in hot locations, or where acid or other fumes are present, the Dravo Corp., Machinery Division, 300 Penn Ave., Pittsburgh, Pa., has announced an air-cooling unit which can be fitted to the top of the crane cab and requires only an electric power connection for its operation. All equipment is inclosed in a steel frame and housing. The air supplied to the cab is cooled, cleaned and constantly circulated, while dust and smoke are dissipated and even acid fumes are eliminated by a special fume absorber.

### DIELECTRIC HEATER

FIRST of a new complete line of dielectric heating units to be offered during 1946 is a standard 2-kw. unit announced by Allis-Chalmers Mfg. Co., Milwaukee, Wis. The unit is designed for simplicity of control. Frequency can be varied through a wide range by a front panel control. An automatic timer controls heat sequence from 2 seconds to 20 minutes, as selected. Among anticipated applications are preheating of plastics, processing of rubber and synthetic materials, and sterilizing medical supplies.

### EQUIPMENT BRIEFS

RAPID non-destructive measurement of thickness of non-conductive coatings on non-magnetic base metals is claimed to be accomplished with an accuracy of 3 percent of full scale by the Filmeter, NRL Model 1, announced by American Instrument Co., Silver Spring, Md. This meter is a battery-operated, electronic beat-frequency oscillator, contained in a steel case weighing approximately 11 lb.

ARMSTRONG MACHINE WORKS, Three Rivers, Mich., has now announced two new steam-type humidifiers of simpler design than the types previously produced. In the new humidifiers a venturi nozzle to discharge the steam replaces an electric fan and motor used on the older Armstrong models. One type has a solenoid valve which controls the discharge of steam automatically, the other a hand operated valve for manual control. Quick mixing of steam and air is said to be assured by the venturi.

ALL ENGINEERING, sales, fabricating and installation of the Supertherm hot-water heating system in North and South America has been taken over by Blaw-Knox Co. Pittsburgh, Pa., from J. O. Ross Engineering Corp., New York. This system, utilizing super-heated water for industrial heating, has been employed widely in Europe and was introduced on to this continent in 1935 where installations were made in many important plants.

FOR MECHANICAL operation, installed on the tool carriage of a lathe, rather than for hand operation, the Metallizing Engineering Co., 38-14 30th St., Long Island City 1, N. Y., has developed the Type Y metallizing gun for heavy duty continuous operation.

Since this gun is able to disregard weight and size limitations, it is said to be able to double previous spraying speeds and greatly reduce wear and parts replacement.

COMBINATION of a full-vision gas mask with a complete head-covering hood of neoprene, to give protection both against toxic gases and against splashes of harmful substances, has been announced by Industrial Products Co., 2777 North 4th St., Philadelphia 33, Pa. The gas mask may be either of the canister type for emergency or short-period use, or of the hose type for attaching to a compressed air line.

MORSE-BOULGER DESTRUCTOR CO., New York 17, N. Y., has purchased Chem-Feeds, Inc., Providence, R. I. and will carry on the business as the Chemical Feeders Division of Morse-Boulger Destructor Co. The company's principal product, the Vari-Feeder, features speed control, pumping at various rates up to 400 strokes per minute.

A NON-ELECTRIC magnetic separator for the removal of tramp iron from liquids and pulps has been developed under the name of Cesco by the Columbia Engineering Service Co., 593 Market St., San Francisco, Calif. Employing permanent Alnico magnets, the device is said to possess a powerful magnetic field and a long life. The design complies with sanitary requirements.

SHEET RUBBER filtering materials containing up to 6,400 holes per square inch are now available again to civilian users after a long period of wartime unavailability, it has been announced by the United States Rubber Co., Rockefeller Center, New York. During the war the material was used in the preparation and administration of blood plasma and in the filtering of special chemicals for war industries.

A SIMPLIFIED boiler design requiring 40 percent less space than average boilers of like capacities has been announced by John Phillips Badenhausen, Inc., 1804 Packard Building, Philadelphia 2, Pa. It is claimed that large grate and furnace area can be provided and, furthermore, that easy cleaning is possible on account of the overhead position of the steam drum to which both primary and secondary tubes are directly connected. Priming and surging are said to be eliminated.

TO FACILITATE centralized control of valves, the J. A. Zurn Mfg. Co., Erie, Pa., has developed a valve control assembly consisting of flexible cable for transmitting torque to the handle of the valve (or a rod or pipe connected by universal joints); a remote valve control box, and the necessary accessories. Through this means, valves in remove or difficulty accessible locations can be controlled from a single control board.

GENERAL BOX CO., Chicago Ill., is now manufacturing shipping pallets and skids under the name of Generalift. These devices will be available designed to meet the needs of individual users.

## CHECK VALVE

EMPLOYING a principle similar to that of the Flexflo valve announced in our March 1944 issue, the Grove Regulator Co., 6527 Green St., Oakland 8, Calif., now has developed the Chexflo valve shown in an accompanying illustration. The device consists of a synthetic rubber tube stretched over a slotted, cup-shaped metal core, the tube expanding to open and contracting to close. Thus the tube expands when flow occurs in one direction, closing immediately, prior to the commencement of back flow, should the flow tendency reverse. The valve is claimed to be suitable for the handling of highly corrosive gases and liquids and is furthermore claimed to improve in service due to the fact the flexing adds life to the rubber sleeve.

## CAR DISCHARGER

DESIGNED to speed up the unloading of coal cars, but doubtless suitable for the unloading of other granular materials as well from hopper-bottom cars, a new shaker has been developed by Robins Conveyors, Inc., Passaic, N. J. The shaker is placed on top of a loaded car and a button is pressed to start an electric motor, whereupon seismic action results and the coal flows out of the bottom of the car. It is claimed that about two minutes is the average unloading time although in tests conducted by one of the leading railways, one car was unloaded in 1½ minutes and the longest time encountered, with coal that was extremely wet, was seven minutes. Only two men are required to operate this equipment. In contrast, by the old method of unloading, four to six men often required as much as two hours per car.

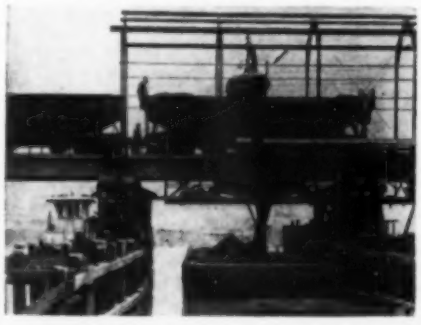
## VENT VALVE

SIZES from 2 to 24 in. are available in a new line of vertical vent valves for atmospheric storage tanks now being produced by Black-Sivalls & Bryson, Inc., Kansas City 3, Mo. The sealing element in this valve is a gasket of neoprene or other synthetic rubber contacting the end of the discharge pipe around its inner periphery and supported at its outer edge by a cover. Through this arrangement the pressure in the tank seals the valve tightly against leakage until the set pressure (up to 1 lb.) is reached, at which time the valve cover lifts, pulling the gasket from its contact with the valve body and relieving pressure from the tank. When pressure in the tank again drops below the valve setting, the cover falls to rest on supporting lugs, and once more the cantilever gasket seals the valve tightly. Various opening pressures from 2 ounces to 16 ounces can be obtained by adding or removing weights inside the cover. All valves open at 0.5 ounce vacuum.

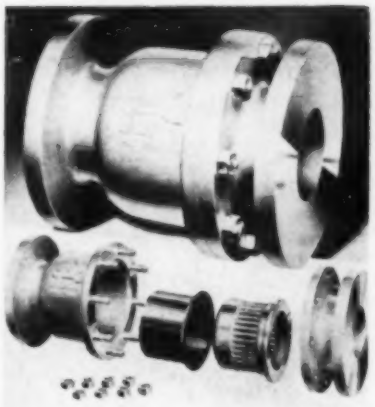
## SMALL CAPACITY PUMP

VARIABLE feed rates at small capacity for laboratory and semi-works uses can be secured with the Sigmamotor, a novel pumping device developed by E. R. Cornell, 211 82nd St., Niagara Falls, N. Y. The device in itself is not a pump, but when a piece of resilient tubing is connected through it, it applies a motion on the outside of the tube in the form of a progressive kneading action which, without valves or auxiliary apparatus, produces a uni-directional flow through the tube. This action is produced by a series of presser bars which are moved in sequence against the side walls of the tube with a sort of wave motion. A wide variety of flow rates can be secured without changing the speed of the Sigmamotor, simply by changing the

**Shaker for discharging coal cars**



**Rubber-sleeve check valve**



**Vent valve for storage tanks**

**Sigmamotor for small scale pumping**

size of flexible tubes used or by connecting the suction side of one size of tubing to the delivery side of another size in series with it and also operated on by the presser bars. Gases, too, may be handled and vacuum up to 27 in. Hg may be developed and maintained, it is claimed.

### UNIVERSAL CYLINDER

STANDARDIZED cylinders that operate by air, water or oil pressure, and permit almost universal mounting applications, have been announced by Engineering Products Co., Los Angeles, Calif. Manufactured in quantity, these cylinders are said to be available off the shelf in numerous diameters and stroke lengths, for many applications where it is desired to produce reciprocating motion hydraulically or pneumatically.

### ADJUSTABLE RECEIVER

A NEW pneumatic receiving instrument for automatic control to which two new mechanisms have been added to facilitate adjustment to the process has been announced by Brown Instrument Co., Philadelphia, Pa. Known as the Adjustable Indexet, the instrument includes adjustment for "span" and "zero shift." The span adjustment permits a change between the span through which the control point is moved, and the change in transmission pressure which moves the control point. The span dial is calibrated in terms of the distance in pecent of full scale that the control index will move along the chart for full scale change in pressure. Thus this adjustment is one for multiplying and dividing. The zero adjustment, however, adds or subtracts a constant value. This adjustment uses a dial calibrated in terms of full scale and moves the zero position along the chart. It is claimed that the control point is undisturbed when making adjustments of this instrument, nor is it necessary to disturb the chart. The range of span adjustment is from zero to 200 percent, and of zero adjustment, from −100 to +100.

### AIR FLOW INDICATOR

TO ENABLE users of ventilating systems to determine at all time the percentage of maximum flow that is passing through a duct, the Dollinger Corp., Rochester 3, N. Y., has introduced the Flocator, a simple vane type flow indicator. An important use is to determine when the flow has been reduced seriously by dirty filters. The instrument is adjustable, and can be set to show 100 percent flow rate when the filters have just been renewed, after which the loss in flow that occurs as the filters foul will be indicated as a percentage of the original flow rate. Two sizes are available, one for small and one for large ventilation systems. Loss of flow from any other cause than filter plugging will, of course, be indicated.

### CARBOY TRUCK

SIMPLICITY in the handling of carboys is claimed for a new truck developed by Palmer-Shile Co., 7141 West Jefferson Ave., Detroit 17, Mich. As indicated in the accompanying illustration, it is only necessary to roll the truck up against the carboy and drop the gripping yoke over the top as shown; then pull back on the truck handles and the loading is accomplished. Hardened steel studs on the truck frame hold the load in place. To unload it is simply necessary to tip the truck forward and release the gripping yoke. Weighing 75 lb., the truck has a capacity of 500 lb.

### SHIELDED ROTAMETER

DESIGNED particularly for use in the corrosive conditions encountered in process industries is the new Full-View Rotameter with safety shielding, recently announced by Brooks Rotameter Co., P. O. Box B-122, Lansdale, Pa. The design is based on simple square block end fittings which are fastened together rigidly by heavy flat side plates. The safety shielding is obtained by the use of safety glass windows on the front and rear, held in place by stainless steel window frames with all surfaces gasketed to prevent leakage.

The construction used will be evident from the accompanying view. The instrument is equipped with an interchangeable precision metering tube and the space between the side plates permits accurate float position reading, even from an angle. The metering tube may be replaced readily without taking the meter out of the line. End fittings are universal, permitting connections in four directions 90 degrees apart. Sizes available range from ¼ to 4 in. pipe size, with screwed or flanged connections. A variety of construction materials can be obtained, depending on service requirements. Remote recording, recording-controlling, and flow totalization variations of this instrument can be secured.

### EQUIPMENT BRIEFS

MOISTURE removal from air lines and gas lines is the function of the Gasflux 636 Series dryer announced by Gasflux Co., 198 Wayne St., Mansfield, Ohio. Three types are available, depending on the required drying efficiency. One employs Fiberglas as a mechanical remover of entrainment; a second uses calcium chloride as the absorbing medium, and a third for complete moisture removal employs activated alumina.

A NEW MODEL Red Head Thermex high frequency dielectric heating unit for 5 kw. delivered energy has been announced by the Girdler Corp., Louisville, Ky. This device will raise the temperature of 4 lb. of average material 170 deg. F. in about one minute. The unit is equipped with all necessary automatic controls and safety features, according to the maker.

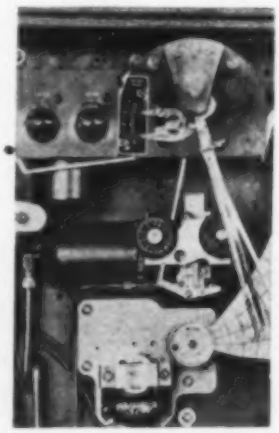
USERS of precision-bore glass tubing of almost any conceivable design can now secure domestically produced tubing from Fischer & Porter Co., Hatboro, Pa. This company is now using its Glo-Tech glass forming process not only for its own needs but to meet the requirements of others as well. Glass parts for scientific instruments of many kinds can thus be formed with tolerances held to 0.0002 in. or less.

TO PERMIT rapid repairs of leaks in tanks, the Perma-Line Rubber Products Corp., 1840 North Damen St., Chicago 47, Ill., has introduced the Perma-plug. A flange part which fits inside the tank is rubber covered. When a leak occurs a hole is drilled through the tank and the Perma-plug is installed from the inside and held in place by a stud inserted through the hole and fastened by a lock washer and nut on the outside. Repairs can be made, it is claimed, in as little as 15 minutes.

New carboy truck

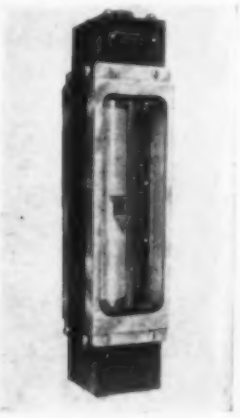

Standardized hydraulic cylinder

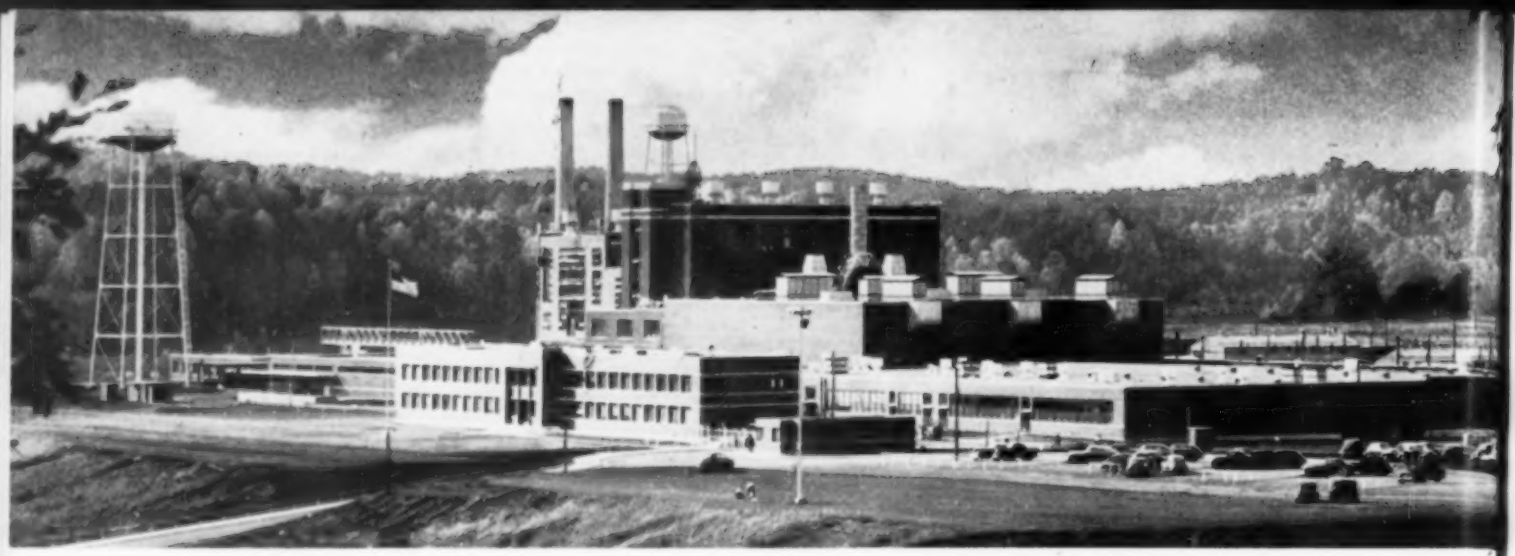
Pneumatic receiver



Flow indicator for ducts


Safety-shielded rotameter





**Nylon salt, hexamethylene diammonium adipate, is polymerized and made into yarn at this Martinsville, Va., plant and at Seaford, Del. Another plant is under construction near Orange, Tex.**

# NYLON PRODUCTION

NYLON is one of the great chemical and engineering developments of all time. The nylon salt, hexamethylene diammonium adipate, is made at the Belle, W. Va., plant of the E. I. du Pont de Nemours & Co. and shipped to the company's plants at Seaford, Del., and Martinsville, Va., (a plant at Orange, Tex. is under construction) for conversion to yarn.

Conversion of the salt to nylon yarn is carried out in many steps or stages: (1) Evaporation of the water in which the salt is dissolved; (2) polymerization of the material; (3) extrusion of the polymer onto a casting wheel; (4) chipping the hardened material; (5) blending; (6) melting the chips; (7) spinning; (8) drawing to develop strength and elasticity; and the numerous operations associated with the handling of any type of yarn.

A water solution of the salt on arrival at the yarn plants is stored in tanks located out of doors. It is pumped to the sixth floor where a batch is divided between two evaporators. Acetic acid is added to stabilize viscosity. After evaporation the solution flows through a manifold to the autoclave. The action of the autoclave is two-fold: (1) There is evaporation of water in which salt is dissolved; and (2) polymerization. Autoclaves are filled with nitrogen under 40 to 50 lb. pressure. Pigment is added to the autoclave mass soon after it has commenced to boil.

When polymerization has been completed the mass is extruded in a ribbon onto the casting wheel. As the hardened translucent, milky-white ribbon leaves the drum it is cut into chips or flakes. These flakes fall into a portable receiver and are blended.

Flake polymer is conveyed to the spinning machines. Filaments pass down through a cooling chamber and are gathered into a bundle. The bundle continues through the many operations in the textile yarn section of the plant.

For a more detailed article on the process refer to pages 96-99 of this issue.

CHEMICAL & METALLURGICAL ENGINEERING

*March, 1946*

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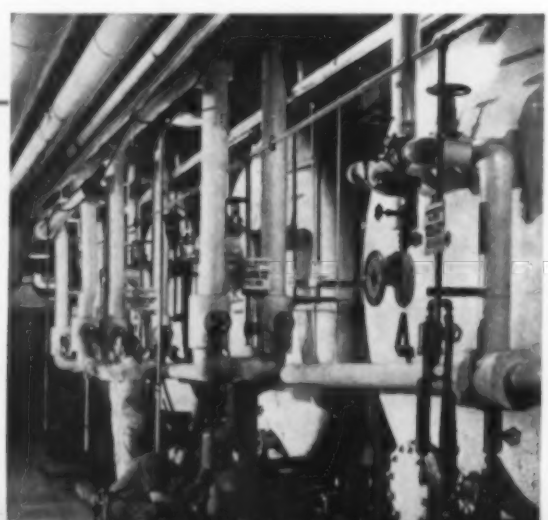
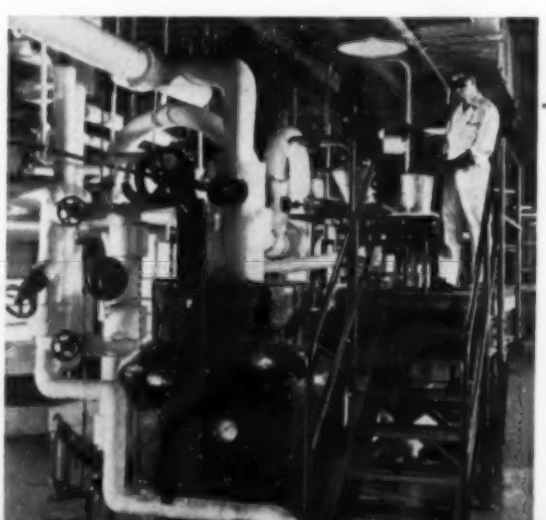
**1 Salt solution is stored in large tanks. One end of each extends into processing building**

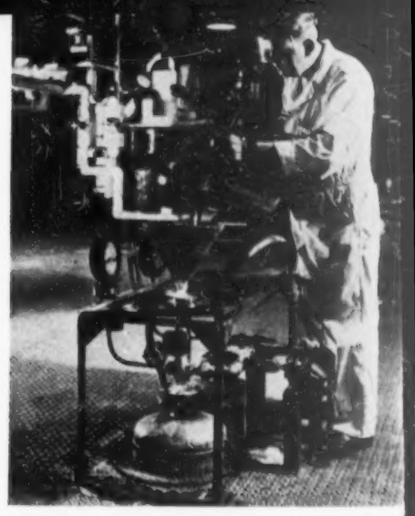


**2 Acetic acid is added to evaporator charge and water is removed at atmospheric pressure**



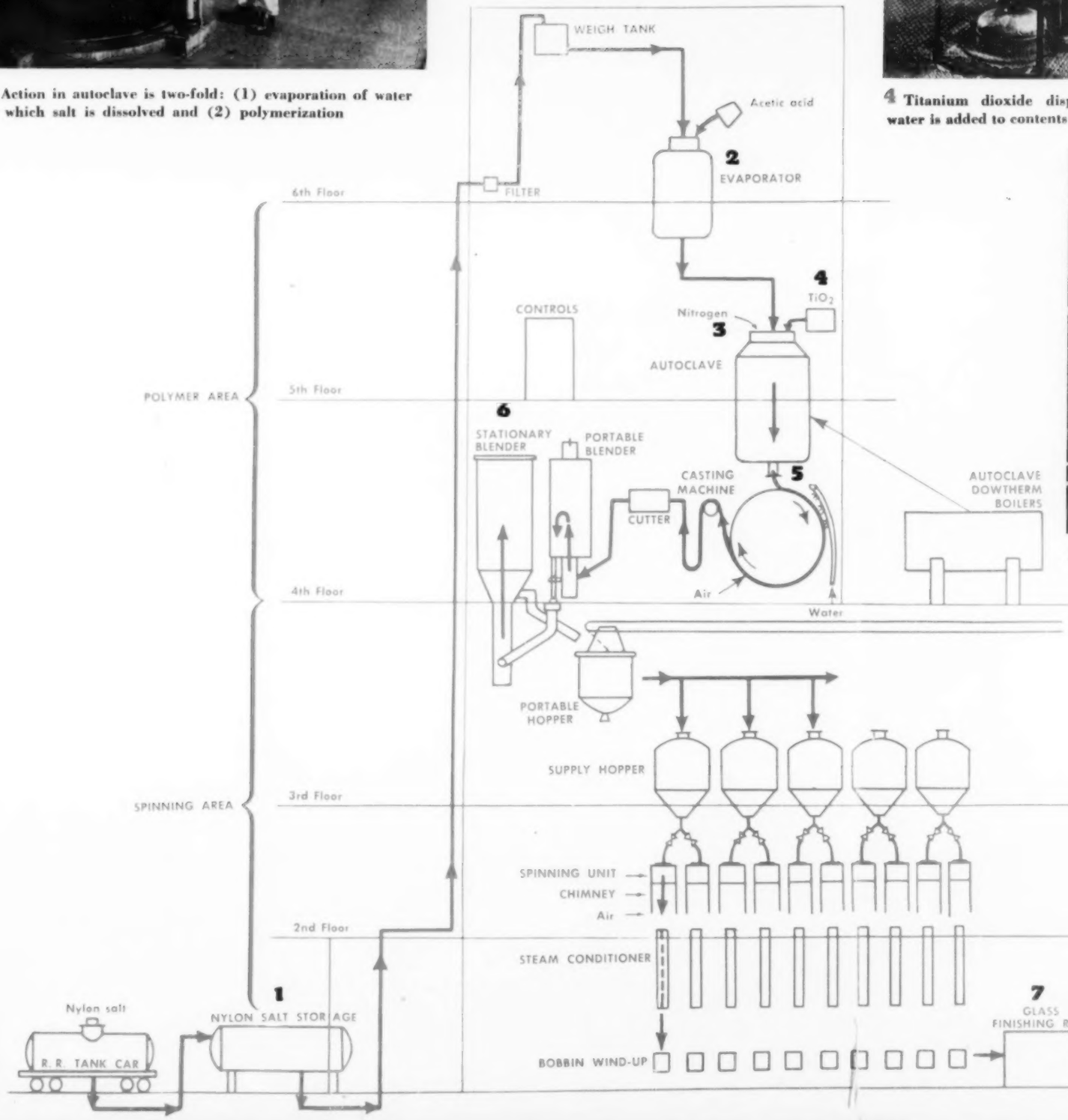
3 Action in autoclave is two-fold: (1) evaporation of water in which salt is dissolved and (2) polymerization

A *Chem & Met* PICTURED FLOWSHEET

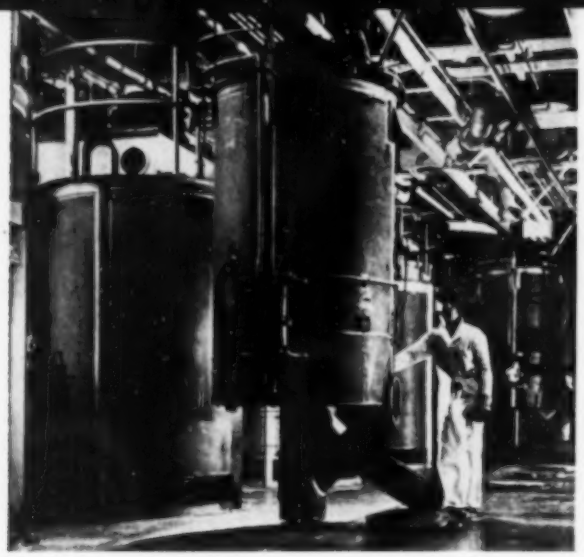


4 Titanium dioxide dispersion in dist water is added to contents of autoclave

5 Ribbon of p ing wheel. Cu

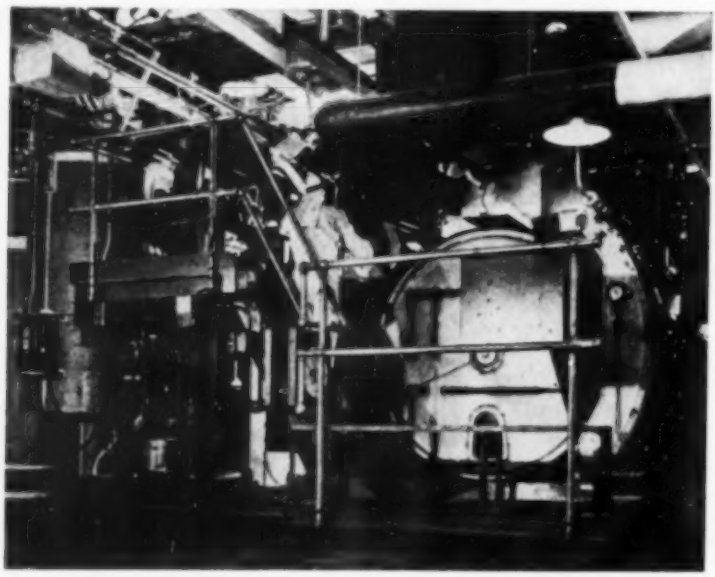


**4** Titanium dioxide dispersion in distilled water is added to contents of autoclave

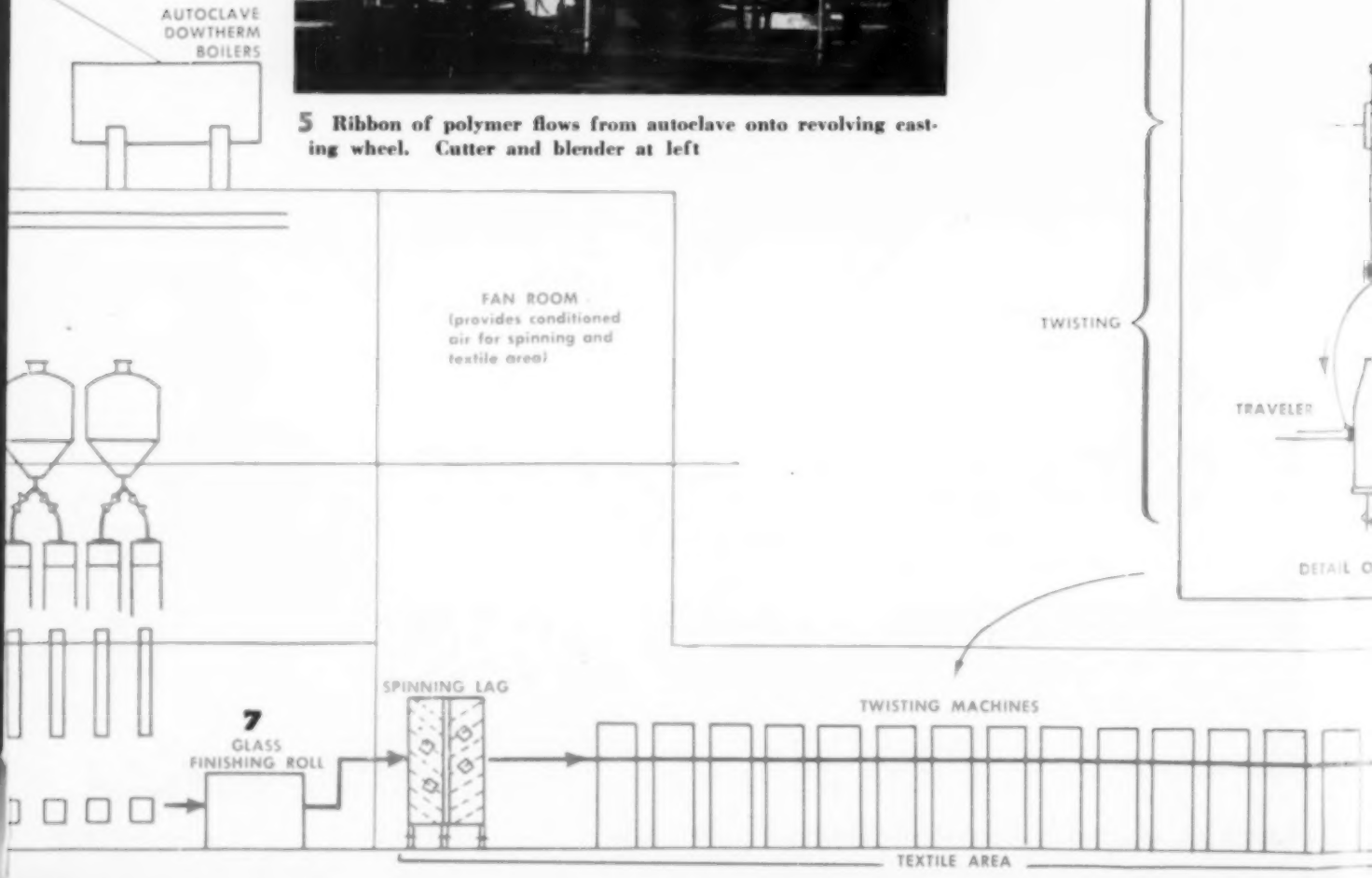


**6** From portable blenders (center) nylon flakes are fed into stationary blenders (left)

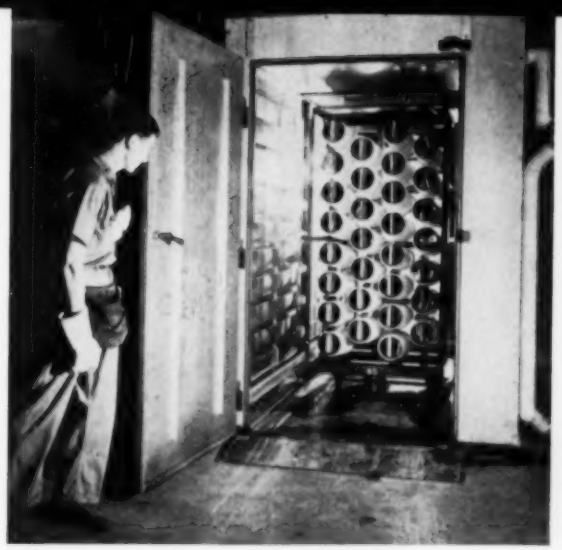
**7** Yarn is wound from substance (sizing)



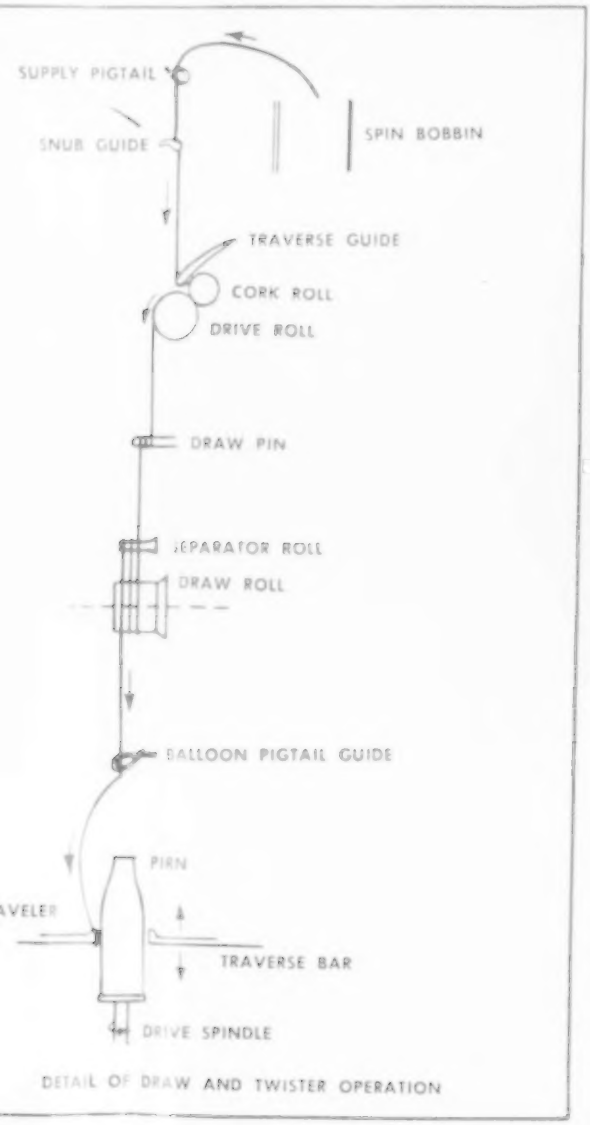
**5** Ribbon of polymer flows from autoclave onto revolving casting wheel. Cutter and blender at left



wound from one spool to another, passing over a gummy (sizing)



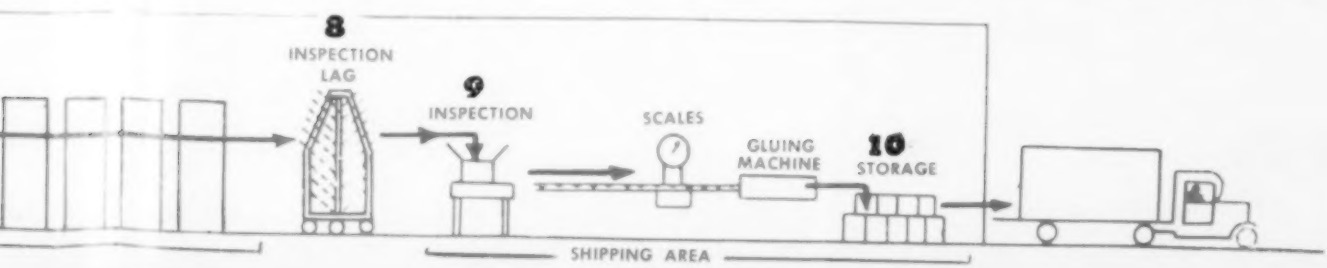
8 Nylon yarn is "baked" in twist setting ovens before it is wound on spools and cones

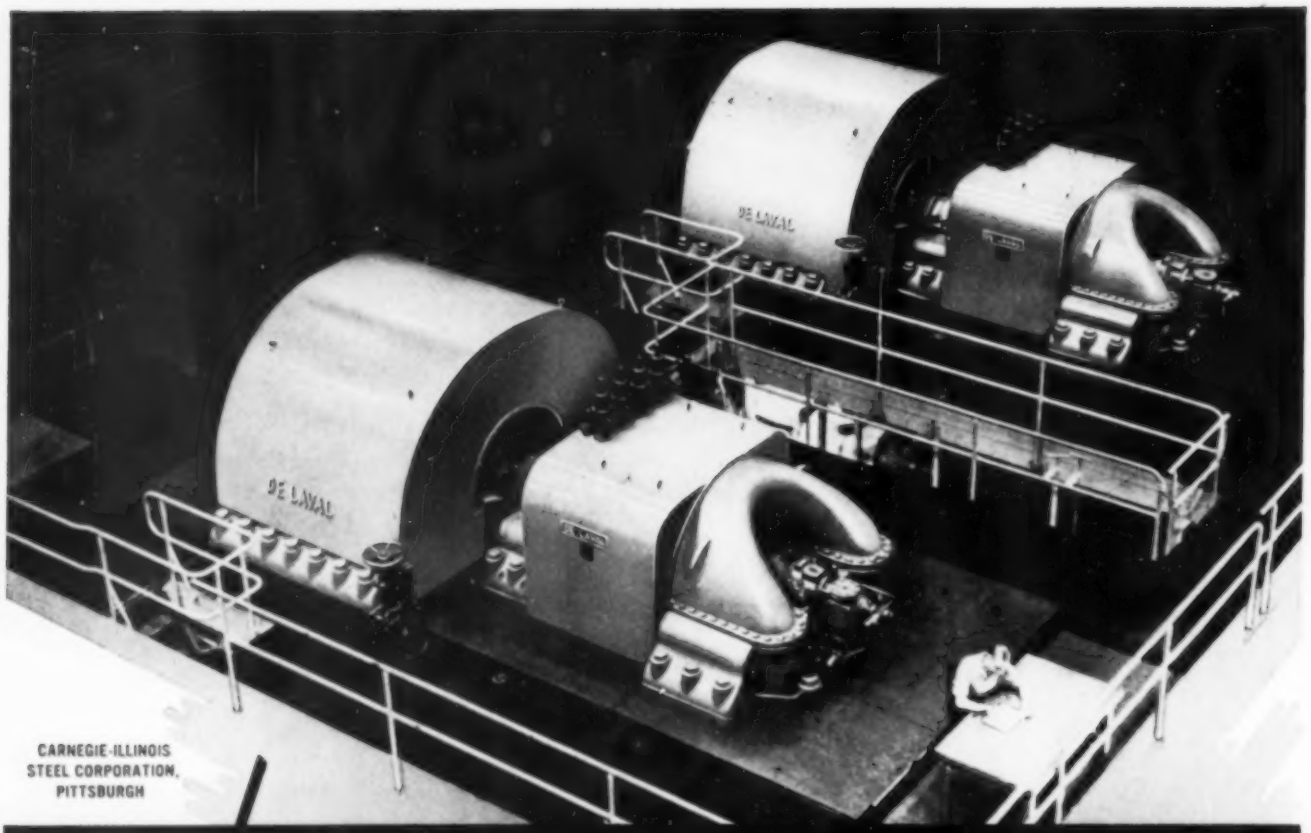



DETAIL OF DRAW AND TWISTER OPERATION

10 Yarn by the "train-load" speeds from finishing areas to be inspected before shipment from the plants of the E. I. du Pont de Nemours & Co. at Seaford and Martinsville

9 Careful inspection is given cones of yarn before they are wrapped






CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH

# WORLD'S RECORD BROKEN AGAIN!

## by FURNACE EQUIPPED WITH DE LAVAL BLOWERS

For the second time in two years, the world's record has been broken for pig iron production from a single furnace served with De Laval turbine-driven blast furnace blowers.

During the month of July, 1945 the No. 2 Furnace of the Edgar Thompson Works of the Carnegie-Illinois Steel Corp. produced a record-breaking 50,590 tons.

The De Laval blowers at the Edgar Thompson Works, with a capacity of 97,800 c.f.m. against 30 p.s.i., were designed for the highest maximum steam pressure (700 p.s.i) and temperature (825 F.) ever used for this service.

CONSULT THE DE LAVAL STEAM TURBINE CO. FOR CENTRIFUGAL BLOWERS AND COMPRESSORS OF ADVANCED DESIGN.

3833

TURBINES • HELICAL GEARS
WORM GEAR SPEED REDUCERS
CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

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STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

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# From End to End of Power Piping Uniform Quality Stands Guard

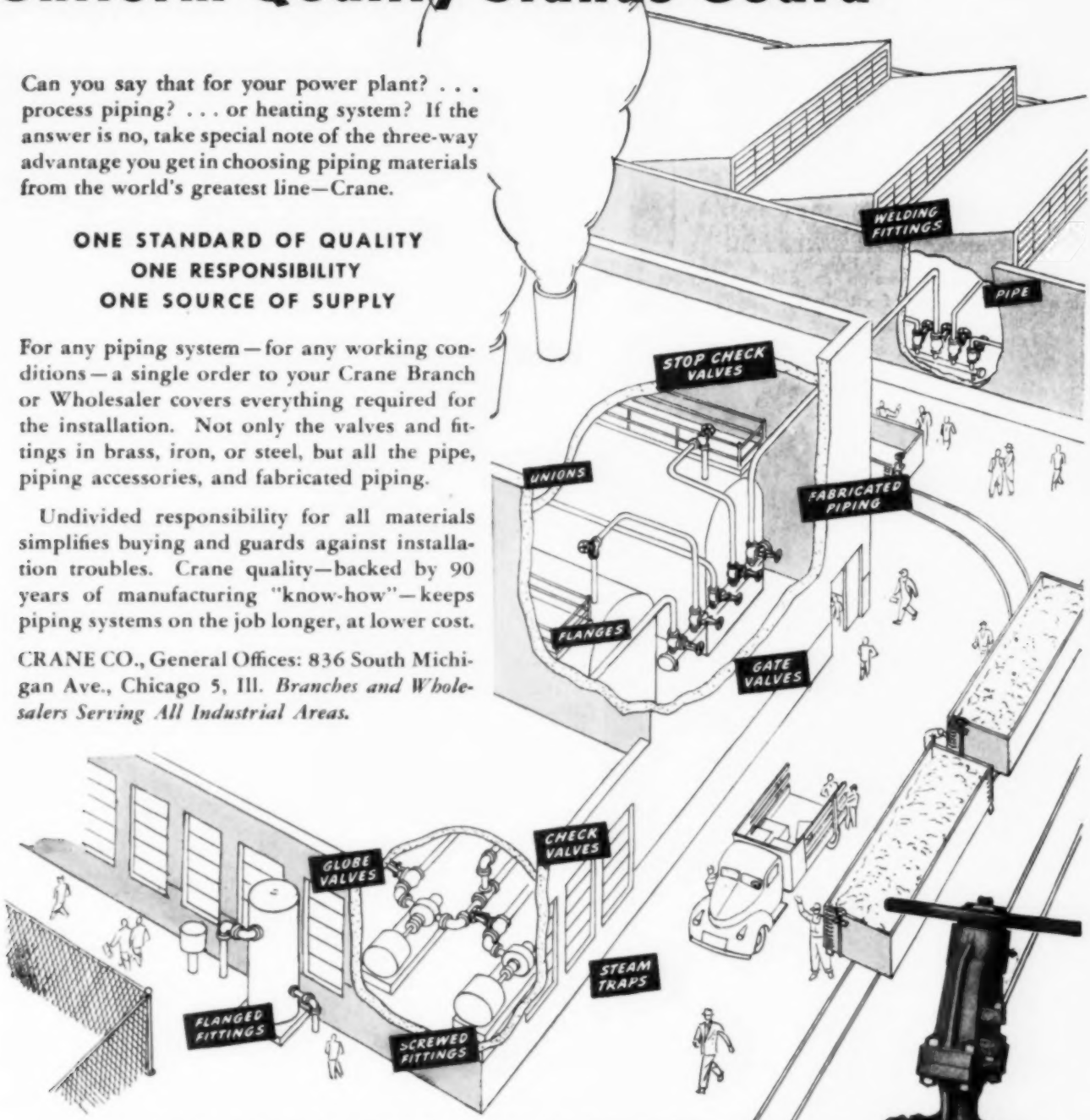
Can you say that for your power plant? . . . process piping? . . . or heating system? If the answer is no, take special note of the three-way advantage you get in choosing piping materials from the world's greatest line—Crane.

**ONE STANDARD OF QUALITY**
**ONE RESPONSIBILITY**
**ONE SOURCE OF SUPPLY**

For any piping system—for any working conditions—a single order to your Crane Branch or Wholesaler covers everything required for the installation. Not only the valves and fittings in brass, iron, or steel, but all the pipe, piping accessories, and fabricated piping.

Undivided responsibility for all materials simplifies buying and guards against installation troubles. Crane quality—backed by 90 years of manufacturing "know-how"—keeps piping systems on the job longer, at lower cost.

CRANE CO., General Offices: 836 South Michigan Ave., Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas.*







(*Right*) Typical of the uniformly high quality in Crane products—Crane Alloy Steel Wedge Gate Valves. The 600-pound class, with Exelloy to No. 49 Nickel Alloy seating, is recommended for steam, water, gas or air up to 850° F. maximum; with Stellite to Stellite, for steam up to 1000° F.; with Exelloy to Exelloy, for oil or oil vapor up to 1100° F. Screwed, flanged, or welding ends. See your Crane Catalog for complete specifications.

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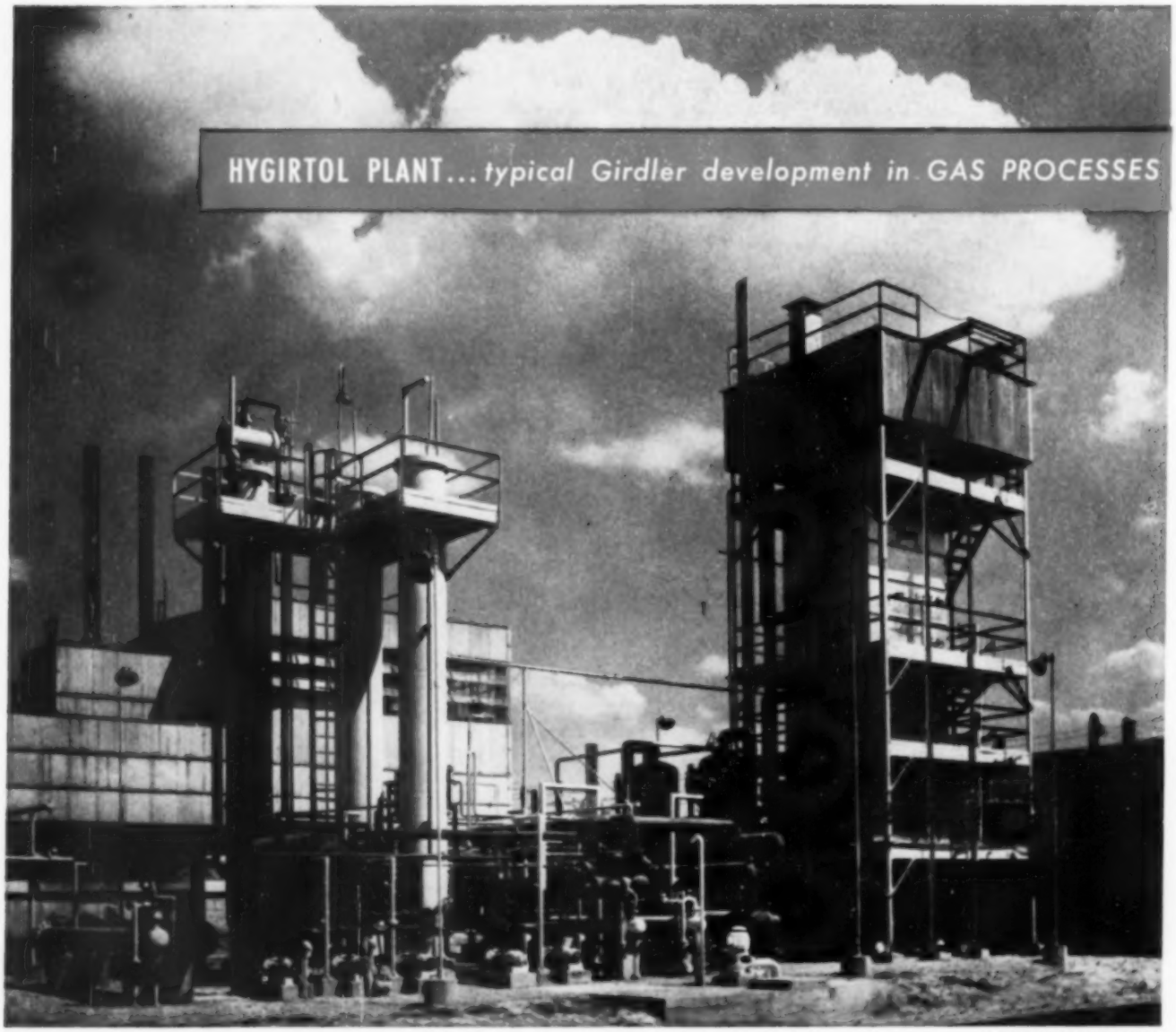


# "Proof of the pudding..."

WORK done is the best evidence of ability to do. Here is a photograph of a representative Girdler built plant.

Employing the economical hydrocarbon-steam reaction, this Girdler HYGIRTOL plant manufactures hydrogen of higher purity than has been heretofore achieved by any other commercial process. Savings of 60% in operating cost alone have been reported from one installation.

Girdler originated the GIRBOTOL Process for the effective, economical removal and recovery of hydrogen sulphide and carbon dioxide from gaseous mixtures.

They have engineered and constructed gas processes installations for virtually every industrial purpose. During the war period, this amounted to more than 150 major installations of many kinds.

For a dependable answer to your gas processes problem, whatever it may be, put Girdler's versatile, practical experience on the job.

• • •

Girdler offers processes for *gas manufacture, purification, separation, and dehydration.* Consult Girdler about your problems concerning *hydrogen sulphide, carbon monoxide, carbon dioxide, inert and controlled atmospheres, natural gas, refinery gases, liquid hydrocarbons, hydrogen, nitrogen.*

**Write for your copy of Girdler's new book . . . *"HYDROGEN"***

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**The GIRDLER CORPORATION**

*Gas Processes Division, Dept. CM-3, Louisville 1, Ky.*
*New York Office . . . 150 Broadway, New York 7, N. Y.*

# NEW PRODUCTS AND MATERIALS

R. W. PORTER, Assistant Editor

## ORGANIC CHEMICALS

Two new organic chemicals, now available in experimental quantities, have recently been announced by the Hooker Electrochemical Co., Niagara Falls, N. Y. The first of these, dimethyl cyclohexane, is a hydrogenerated xylene but in its chemical behavior resembles the aliphatic hydrocarbons more than the aromatic. It can be oxidized or reacted with halogens to yield products of potential value in organic syntheses. This new organic solvent is a water white liquid of mild odor, consisting of a mixture of meta-, para-, and ortho- isomers. It has a freezing point of below —65 deg. C. and a boiling point of 120 deg. C. and weighs 6.47 lb. per gal. at 15.5 deg. C. It does not decompose at the boiling point and does not react with the common bases or acids. Its water solubility is low and it is miscible with most common solvents.

Benzotrifluoride is also available only in experimental quantities and is a water-white liquid with an aromatic odor. It is completely miscible with most common solvents and its thermal stability is good. It weighs 9.98 lb. per gal. at 15.5 deg. C. and has a low solubility in water. Suggested applications are in the fields of dyestuffs, medicinals, chemical syntheses and insecticides.

## WOOD FINISHING COMPOUNDS

Produced in all standard modern colors used in wood finishes Filcotone is a combination stain and filler for furniture finishes. It is now being introduced by the Glidden Co., Cleveland, Ohio. Filcotone stains, wash-coats and fills in a single application and air dries in one hour. Drying time can be decreased to one-half hour at temperatures of 135 to 140 deg. F. It may be applied with either brush or spray on cabinets, furniture or any wood articles normally stained and filled. By eliminating certain operations required in the first stages of finishing, this material is claimed to save on handling and application costs.

## WETTING AGENT

Although manufactured in limited quantities during the war Alrosal, a new wetting agent, is now available on an unrestricted basis from the Alrose Chemical Co., Cranston, R. I. A detergent and wetting agent of the fatty amide type, it contains active organic ingredients of 87 percent. It is a freely flowing amber liquid which congeals at 0 deg. C. and has a mild odor. It is miscible with water and is also soluble in a number of organic solvents. In addition it is miscible with vegetable oils, fats and waxes. Alrosal is suggested for use as a water softener and may also be used in soap and cleaning compounds.

## ALKALINE INK

Resulting from an investigation of the effects of the ordinary commercial writing inks on record paper, an alkaline type of ink has been developed by the Organic Chemistry Section of the National Bureau of Standards. This ammoniacal type of ink makes permanent records with little or no deteriorative effect on the paper as is the case when the ordinary acid type inks are used. While this new type of ink is not commercially available it is being manufactured by the Government Printing Office for use in printing government material.

## CONTENTS



## TREE PAINT

Claimed to be superior to the various other materials for treating tree injuries, a new tree paint is now commercially available from the A. C. Horn Co. Inc., 43-36 Tenth St., Long Island City 1, N. Y. It is reported on a basis of extensive tests that tree wounds will heal more rapidly when treated with Horn tree paint than with other materials used for this purpose. It is made of plasticized asphalt, resin and lanolin, and fungicidal preventives consisting of pinene, bornyl acetate and sylvestrenes.

## CORROSION-PROOF COATING

Recently developed by the Lithgow Corp., 333 W. 40th Place, Chicago 9, Ill., a new protective coating known as Cotoid is claimed to be highly resistant to acids, alkalies, chlorides, oils, oxygen, gasoline and alcohol solutions. This material is based on a thermoplastic synthetic resin in which low water-absorption and inert properties inhibit corrosion. The resulting finish is said to be tough, hard, and elastic, and has been used for protecting walls, wood, or steel structural work, and for equipment in food processing plants, wineries, breweries and paper mills. Suggested uses include coating inside and outside surfaces of concrete, steel or wooden tanks used for corrosive solutions, brines and alkalis. It has been tested with a wide range of materials such as acids, gasoline, sour crudes and caustic solutions.

Although Cotoid can be applied by dipping, flowing or roller coating, spraying is the recommended method. Coatings will withstand a maximum temperature in air or vapor of 220 deg. F., while the maximum submerged temperature is approximately 150 deg. F. It is suitable for subzero temperature use. Cotoid is available in 1, 5 and 10-gal. cans and in 55 gal. drums.

## FORTIFIED ANIMAL GLUES

Fortified animal glues promise to add greatly to the life of furniture, and other wood products used in humid climates, according to the National Association of Glue Manufacturers, Inc., 65 West 42nd St., New York, N. Y. In the manufacture of these products the usual glue solution is fortified against mold and extraneous bacteria by the addition of 0.5 percent by weight of an organic mercury fungicide-bactericide to the dry glue. Before wood joints are put together one side is treated with a dilute formaldehyde solution which imparts full moisture resistance and aids the shock resistant properties of the joints. Fortified animal glues possess the following advantages: (1) Non-critical temperature control of adhesives, 120 to 150 deg. F.; (2) no catalyst is added to the glue solutions; (3) water is the only solvent required for the adhesive; (4) no special heat treatment is required; (5) speed of assembly may be widely varied.

## ITACONIC ACID

Now available in limited quantities for laboratory research, itaconic acid has been recently developed by the Charles Pfizer Co., Inc., 81 Maiden Lane, New York 7, N. Y. This unsaturated dibasic acid is a white crystalline solid with a molecular

weight of 130.10 and a melting point of 167-168 deg. C. It is soluble in both water and alcohol. Also known as methylene succinic acid, it can be converted to citraconic or mesaconic acid and forms an anhydride. It may be reduced to yield methyl succinic acid. Various uses are suggested for this new chemical, the most important of which is in the preparation of resins of various types. Its esters can be polymerized to yield colorless, transparent plastics of varying characteristics depending upon the alcohol with which the acid is combined. They can also be copolymerized with other monomers. It is also suggested as a raw material for the preparation of wetting agents.

### PALESTIC

DEVELOPED by Engineering Associates, St. Charles, Ill., a new chemically-treated plaster of paris compound is said to have the strength of stone, but can be molded in as simple a manner as ordinary plaster. This new material is claimed to have advantages over such materials as plaster and plastics for a variety of purposes such as for novel-

**Objects molded from Palestic**

ties, decorative effects, and the production of various industrial products. It is applicable in many instances where plaster is unsuitable and where plastics are too expensive. Palestic is made by adding low-cost chemicals to the water which is used with ordinary plaster of paris. After the solution has been prepared, the technique is the same as used for plaster. Setting time, drying, types of molds, parting compounds are the same, making it readily adaptable to present commercial practice. It is claimed that the cost of the final molded product will be on the order of 5 to 8 c. per lb. Certain dyes may be readily added to obtain colored objects. This new material is suggested for a number of products including patterns, instrument bases, containers, clock and radio cabinets, and display racks. Can be securely adhered to other plastics such as Lucite, styrene, cellulose acetate and bakelite, as well as to metals, wood and glass. It is said to be extremely resistant to water penetration and can be sanded, sawed, polished, etc.

### COLOR RUSTPROOFING

IT IS now possible to impart color to Parkerized iron and steel surfaces according to the Parker Rustproof Co., Detroit, Mich. Color parkerizing provides a complex phosphate coating, integral with the metal surface, completely insoluble in water, which does not smudge, chip or peel. It is said to effectively retard the spread of corrosion from abraded areas. This new coating is available in gray, blue, purple and green. This coating in the olive-drab color is said to have been used for camouflaging army equipment during the war. It is suggested as a means for identification by color of valves, sprinkler systems, etc.

### CLEANING COMPOUND

A GENERAL-PURPOSE cleaning compound under the trade name of Bex UT-30 concentrated washing compound is now manufactured by the Gaybex Corp., Nutley 10, N. J. This compound is an amber-colored liquid weighing about 8¼ lb. per gal. which, when extended with 10 to 500 parts of water will safely and thoroughly clean any surface to which water may be applied. It is chemically neutral and is claimed to have no adverse effect on skin, cloth, metals or plastics. The optimum dilutions for each particular use may be found by expeimentation. Suggested uses are for industrial shop floors, engines, equipment, walls, tile, office floors, walls, desks, stores and home use. It is available in 5 gal. cans and 54 gal. non-returnable drums.

### FORMALDEHYDE POLYMER

DEVELOPED by the E. I. du Pont de Nemours & Co., Wilmington Del., Trioxane, a cyclic trimeric polymer of formaldehyde is now available in limited quantities for research and development. It can be used as a source of anhydrous monomeric formaldehyde for reaction with various materials. It provides better control of reaction, better yields and quality of product, shorter reaction time, and a smoother reaction than is possible with aqueous formaldehyde or other formaldehyde polymers. Trioxane is stable in alkaline or neutral solutions, is miscible with many types of organic compounds and is soluble in a wide range of materials. It acts as a plasticizer and as an anti-gelation agent for zein, and is soluble in water and alcohol. It may be used in reactions with such compounds as phenols, amides, amines, proteins, hydrocarbons and many others.

**Properties of Trioxane**

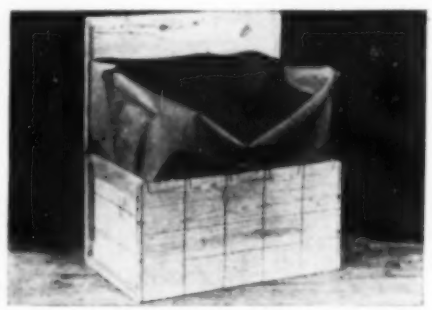
| | |
|---|---|
| Colorless, crystalline compound | |
| Molecular weight | 90.05 |
| Odor | Mild, Pleasant |
| M. p., deg. C. | 61 |
| B. p., deg. C. | 115 |
| Flash point, deg. C | 45 |
| Density (molten) at 65 deg. C. | 1.170 |

### VITAMIN ASPIRIN

ASPIRIN is now being fortified with vitamin A by the Lakeside Laboratories, Milwaukee, Wis. and the Winthrop Chemical Corp., New York, N. Y., according to the Wisconsin Alumni Research Foundation, which holds the patent for this product. Designed to counteract the effects of aspirin which reduces blood clotting characteristics the quantities of vitamin A added to the aspirin are said to remove this danger in cases where large doses of aspirin are required. One part of vitamin A to 1,000 parts of aspirin provides average protection for most users. This new product is expected to be of benefit to sufferers from rheumatic fever, arthritis and similar cases for which massive doses of aspirin are a part of the recognized treatment.

### WATERPROOF PACKAGE LINER

DEVELOPED during the war by Protective Coatings Corp., 689 Main St., Belleville, 9, N. J., a new flexible and resilient waterproof package liner fabric is now commercially available. Designated as Aquastop, this chemically-treated fabric will keep packaged materials perfectly dry even after many weeks of submersion in water. Aquastop is claimed to withstand exposures to changes in temperature from —20 deg. F. to 170 deg. F. at high relative humidities without cracking, tackiness, flow, loss of flexibility or waterproofness. All seams of this package liner may be caulked with Aquastop cement which effects a tight seal of adjacent liner panels, thereby producing a completely



**Package lined with Aquastop**

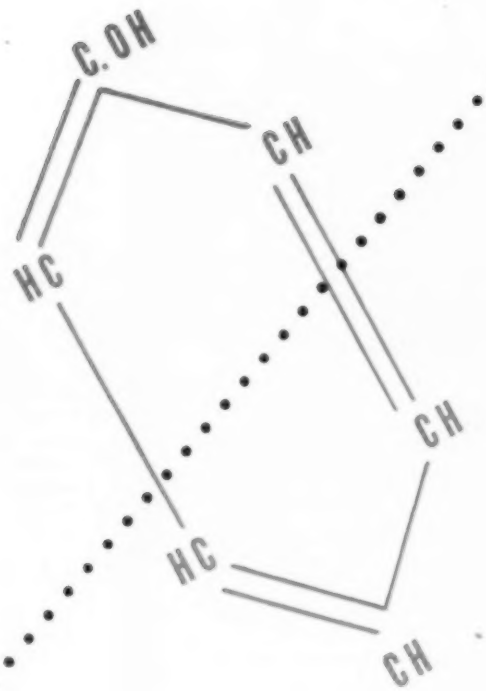
sealed barrier between the contents and the exterior wooden shipping box. Heat-sealed bags can be manufactured at temperatures of 265 to 310 deg. F. A unique feature of this liner is that while complete water-proofing is accomplished, moisture vapor as high as 10 g. per 100 sq.in. per 24 hr. is transmissible. This "breathing" property of Aquastop prevents condensation of moisture within the package due to temperature changes.

### SILICA GEL

A SERIES of special desiccants under the trade name of Tel-Tale silica gel was developed during the war by the Davidson Chemical Corp., Baltimore, Md. This material indicates changes in relative humidity by changing color. Silica gel is impregnated with cobalt chloride and changes in color from blue to light pink at definite relative humidities. It is now possible with the use of the Tel-Tale desiccant to know exactly when the silica gel needs to be regenerated. This series now covers a wide range of relative humidities.

### PHOSPHATE PLASTICIZER

RECENTLY announced by the Carbide and Carbon Chemicals Corp., 30 East 42nd St., New York 17, N. Y., trioctyl phosphate under the trade name of Flexol Plasticizer TOF is claimed to have many unusual characteristics. This material, now available




**PHENOL** Tremendous capacity for the production of phenol and a long list of interrelated products, has established Monsanto as a major supply source for this basic and versatile chemical. Questions relating to any phase of your requirements are welcomed by Monsanto. Contact the nearest Monsanto Office, or write to MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Mo. District Offices: New York, Chicago, Boston, Detroit, Cincinnati, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

MONSANTO CHEMICALS
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in limited quantities, develops important properties in plasticizer composition including low temperature flexibility, minimum change of flexibility over a wide temperature range, high resistance to water extraction and low volatile loss. It is compatible with vinyl chloride, vinyl chloride-acetate and vinyl butyral resins and the principal types of synthetic rubber. It is also compatible with ethylcellulose and cellulose nitrate and has limited compatibility with cellulose acetate propionate and acetate butyrate, but is not compatible with cellulose acetate nor with polyvinyl acetate resins.

Flexol Plasticizer TOF is a non-volatile liquid with practically no odor. Its physical properties are shown in the table.

**Physical Properties of Trioctyl Phosphate**

| | |
|---|---|
| Molecular weight | 434.6 |
| Specific gravity at 20/20 deg. C. | 0.9262 |
| Vapor pressure at 200 deg. C. mm. Hg. | 2.0 |
| B. p. at 5 mm. Hg., deg. C. | 220 |
| Absolute viscosity at 20 deg. C., centipoises | 14.1 |
| Flash point, open cup, deg. F. | 420 |
| Refractive index at 20 deg. C. $n_D$ | 1.4432 |
| Coefficient of expansion at 20 deg. C., per deg. C. | 0.00081 |
| Solubility in water at 20 deg. C., percent by weight | 0.01 |
| Solubility of water in, at 20 deg., percent by weight | 1.4 |
| Weight per gal. at 20 deg. C., lb. | 7.7 |
| Pound volume, gal. per lb. at 20 deg. C. | 0.13 |

The low weight per gallon of this material provides a higher bulking factor than that obtained with certain other plasticizers, and tests indicate that the films containing this plasticizer are less flammable than films plasticized with such materials as tricresyl phosphate. This plasticizer is useful in vinyl resin solution coatings as well as molded, calendered or extruded compositions. It is especially effective in spreader and calendar coatings for cloth where pliability and good drape are desired.

### DDT CONCENTRATE

A 25 PERCENT DDT concentrate, under the trade name of Pestroy is now manufactured by the Sherwin-Williams Co., Cleveland, Ohio. This concentrate may be diluted with water to make a powerful repellent insecticide which can be sprayed or brushed on any type of surface. It destroys flies, mosquitoes, moths, gnats, fleas, roaches and many other common insect pests. One gallon of Pestroy diluted with four gallons of water makes a 5 percent solution of insecticide that will cover 4,800 sq. ft. of surface. It is odorless and stainless and when diluted with water is non-flammable.

### MILDEW-PROOFING AGENT

USED extensively during the war for military applications, Hyamine 3258, a textile resin has recently been made commercially available. Manufactured by the Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa., this material found wide use in the prevention of mildew to fabrics in the hot, humid islands of the South Pacific. Hyamine 3258 is a fully substituted alkyl quaternary ammonium, pentachlorphenate which is colorless and odorless in the concentrations used for treating fabrics. It is non-toxic and is non-irritating to the skin at recommended concentrations. It is water soluble and is easy to apply with most types of textile dyeing machinery. This material was found especially useful in applications such as the

mildew proofing of sewing threads for tent and tarpaulin canvasses, knapsacks and other articles of equipment which are commonly exposed to the elements. It is not recommended for permanent protection of articles which are subjected to repeated laundering.

### PLASTICIZER

RECENT announcement of a new plasticizing resin, Nevillac TS, has been made by the Neville Co., Pittsburgh 25, Pa. Now commercially available, this new product has been suggested for use as a plasticizer, softener, impregnant and for waterproof and greaseproof paper coating. Nevillac TS is a clear amber, resinous oil, with a slight phenol odor and is viscous and slow-flowing. It is soluble in practically all solvents except water, glycerine and higher polyhydric alcohols, but is miscible with ethylene glycol and some of its derivatives. It is compatible with the zein, cellulose derivatives, synthetic rubbers, terpene, alkyd, phenolic, vinyl and coumarone-indene resins. This plasticizing oil has the following properties: Average molecular weight, 250; sp.gr. at 30.0/15.6 deg. C. is approximately 1.08; refractive index at 25 deg. C., 1.599; distillation begins at 300 deg. C. with slow decomposition beginning at about 370 deg. C.

### CHLORINE COMPOUND

UNAVAILABLE during the war Pittchlor, a high test calcium hypochloride is now available for civilian uses from the Columbia Chemical Division of Pittsburgh Plate Glass Co., 62 Duquesne Way, Pittsburgh, Pa. Containing a minimum of 70 percent available chlorine, it may be used as a bleach, germicide, or disinfectant. It has been used in water and sewage treatment and also for purifying swimming pool water, for disinfecting and deodorizing locker rooms, showers, etc.

### PROTECTIVE COATING

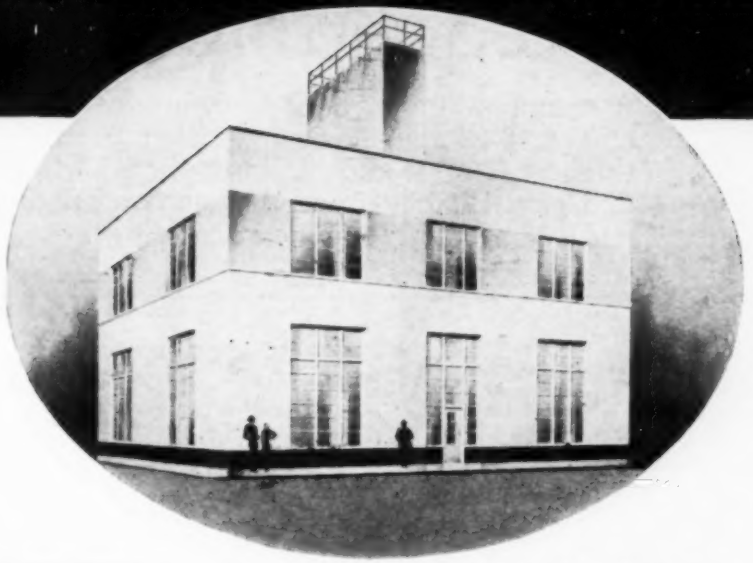
A CHEMICAL resistant maintenance paint, Pen-Kote 500 has been been placed on the market by the Peninsular Chemical Products Co., 6795 East Nine Mile Road, Van Dyke, Mich. Pen-Kote 500. It is an aqueous dispersion of an inert chemical resistant and insoluble plastic together with suitable plasticizers, pigments, etc. It can be brushed or sprayed on fabric, paper, and structural materials such as Celotex, plaster, etc., as well as to the conventional surfaces such as wood, concrete, metal and old painted surfaces. It also is claimed to cover asphaltic paint and materials without bleeding through. It is said to be resistant to acid, alkalis, water, alcohol, salt brine, gasoline, oil and many solvents. This material is claimed to cover all surfaces whether they be hot or cold, wet or dry. Pen-Kote 500 is non-flammable, highly adhesive, and is available in a wide range of colors.

### KNOT SEALER

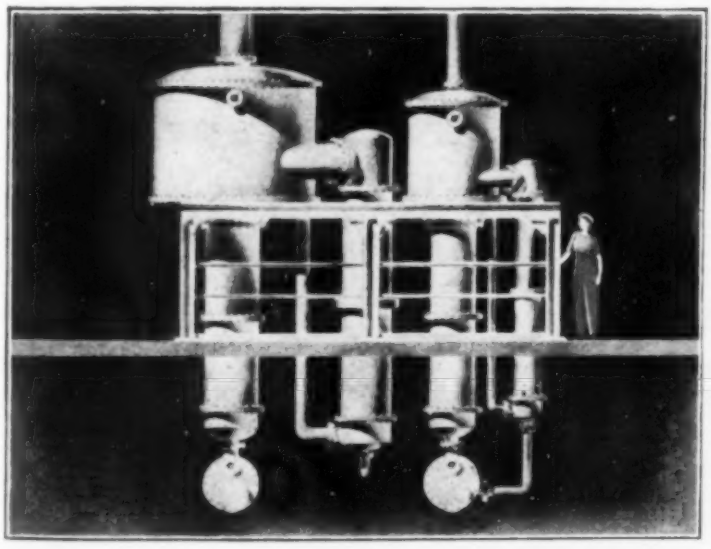
PAINT failures over knots in boards which cause brown discoloration followed by cracking and peeling of the paint over the knot area can now be overcome by using Knot Sealer WP-578 developed by the Western Pine Association, Yeon Building, Portland 4, Oregon. This new formulation which is a

# Emersol PROCESS

FOR THE SEPARATION OF FATTY ACIDS



## for PURITY of PRODUCT



A new high standard of purity for separated stearic and oleic acids is attained by the patented Emersol Process.

This new purity of product results from employment of fractional solvent crystallization which is put to practicable commercial use for the first time, in this process.

Blaw-Knox builds the standard Emersol Process plant for an annual production of 18 million pounds of separated fatty acids. It is a self-contained unit and is housed in such a building as shown above.

Blaw-Knox Bulletin No. 2051 describes the Emersol Process and contains much technical information valuable to chemists, executives, and supervisors.

**Built By BLAW-KNOX** *Exclusive Agent*

**BLAW-KNOX DIVISION** OF BLAW-KNOX COMPANY • 2090 FARMERS BANK BUILDING, PITTSBURGH, PA.

practically colorless, synthetic resin sealer is said to be superior to any other material used for this purpose including shellac or aluminum paint. Tests indicate that exterior house paint will not discolor, chip, crack, scale or peel on areas treated with this material. WP-578 has the following formula by weight: 5.0 parts BV 9700, 60 percent solids (Bakelite Corp.); 0.5 parts Polyvinyl butyral XYHL low viscosity (Carbide and Carbon Chemical Corp.); 9.5 parts of 95 percent denatured alcohol. This sealer weighs approximately 7.5 lb. per gal. and has a coverage of about 500 sq.ft. of surface per gal. It will dry and set in 10 to 15 min., but should be allowed to dry overnight before paint is applied. It is commercially available from a number of companies.

### RUTIN

EFFECTIVE in treatment of conditions arising from high blood pressure associated with capillary fragility, Rutin may now be readily extracted from buckwheat according to a recent announcement from the U. S. Department of Agriculture, Regional Laboratory, Wyndmoor, Pa. Heretofore obtained from flue cured tobacco with only a small yield, this material is expected to be commercially available from several pharmaceutical houses by the end of 1946. A bright yellow non-toxic powder, Rutin, a glucoside, is extracted from green buckwheat 35 days after planting.

### PLASTIC COMPOUND

Now available from the Duorite Plastic Industries, Culver City, Calif., a plastic troweling compound is claimed to be lighter than magnesium, yet stronger than wood. Known as Plastipaste, this material can be used for making heat and electrical insulators, relief maps, art objects, novelties, and containers for various corrosive chemicals.

Plastipaste is a phenolic base resin and is usually mixed with a filler and accelerating compound which causes the resin to harden. It is applied by troweling, in the same manner as cement is troweled and it will adhere to wood and other surfaces which are not coated with a wax parting agent. When rapid hardening is desired this compound can be completely cured without heat in about 30 min. using a special catalyst. Maximum physical properties of Plastipaste are shown in the accompanying table.

**Physical Properties of Plastipaste**

| | |
|---|---|
| Weight, lb. per cu. ft. | 66 |
| Sp. gr. | 1.05 |
| Compressive strength, lb. per sq. in. | 12,000 |
| Flexural strength, lb. per sq. in. | 3,000 |
| Shrinkage | None |
| Heat resistance, deg. F. | Chars at 400 |
| Resistance to acid and alkaline solutions | Good |
| Resistance to water, oils, and solvents | Good |
| Machining qualities | Like wood |
| Normal color | Straw |
| Finish | Smooth |

### DDT GARDEN DUST

THE JAPANESE beetle as well as other garden pests can now be controlled by the use of Knox-Out garden dust, manufactured by the Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa. It consists of a simple dust containing 5 percent DDT and a dusting element. It may also be used for corn earworms, corn borers and potato bugs.

# CHEMICAL ENGINEERING NEWS

### AMERICAN POTASH & CHEMICAL PUBLIC SALE OF STOCK

A PUBLIC sale of 90.5 percent of the outstanding capital stock of the American Potash & Chemical Corp. has been announced by Alien Property Custodian James E. Markham. The concern maintains its principal executive offices in Los Angeles and its principal sales office in New York. It produces muriate of potash, refined potassium chloride, sulphate of potash, borax, dehydrated borax, boric acid, soda ash, salt cake and desiccated sodium sulphate, bromine, bromides, and lithium.

Its plant is located at Trona, Calif., on the edge of Searles Lake with the company owning 2,560 acres of the lake and having an additional 5,960 acres under lease. It also owns two domestic subsidiaries, the Trona Railway Co. and the Three Elephant Borax Corp. as well as a small subsidiary in Great Britain.

Sealed bids on the 478,194 shares will be received until March 27 by the Office of Alien Property Custodian, 120 Broadway, New York. A prospectus, questionnaire for prospective bidders, registration statement and other pertinent data may be obtained from that office. To permit the Office to make a final award shortly after the opening of the bids, prospective bidders must submit information on their qualifications at least 10 days before the sale.

The Custodian vested the stock on October 20, 1942 under the terms of the Trading with the Enemy Act. The stock formerly was owned by Wintershll, A. G., Germany and Salzdetfurth, A. G., Germany, and the estate of August Diehn.

### FISCHER-TROPSCH PATENTS TO BE LICENSED

ALIEN Property Custodian James E. Markham announced the availability for licensing of a group of patents relating to the production of synthetic gasoline by the Fisher-Tropsch process.

Licensing of the patents has been delayed until now pending disposition of claims to exclusive licenses. Licenses are available on a royalty-free, non-exclusive basis for an administrative fee of $15 each.

Several of the patents cover inventions of Franz Fischer of Germany, a pioneer in synthetic fuel chemistry. The Fischer-Tropsch process, based on the hydrogenation of carbon monoxide, was operated extensively in Germany for production of synthetic gasoline, diesel oil and higher alcohols. By variation and further chemical reactions it was used for production of waxes, lubricating oils and fatty acids for soaps and detergents.

A list of the patents may be obtained from the Patent Use and Development Section, Office of Alien Property Custodian, Washington 25, D. C. Full licensing information will be sent to those requesting the list.

### PLASTICS EXPOSITION WILL BE HELD IN APRIL

THE present status of all the plastics and their possibilities for future application in all types of industries will be presented graphically in the first National Plastics Exposition, to be held in Grand Central Palace, New York, April 22 to 27 it has been announced by the Society of the Plastics Industry, sponsoring organization for the Exposition.

The Exposition, first ever held on a national basis in the country's newest major industry, will bring together for the first time in one place and at one time all the industry's leading manufacturers of raw materials and machinery, as well as the companies that fabricate the new and standard plastic products and product parts. Some 200 companies will participate in the Exposition. Attendance will be drawn not only from all parts of the United States, but also Canada, Latin America and Europe.

Concurrently with the Exposition, the Society of the Plastics Industry will hold a convention at which leading authorities will tell about the latest advances in plastics technology and application.

### NEW CAPACITY TO BE ADDED FOR BYPRODUCT COKE

WORK on construction of 106 new coke ovens soon will be started by Koppers Co., Inc., for the Weirton Steel Co. at Weirton, W. Va. There will be two batteries of 53 ovens each with a total carbonizing capacity of 2,600 tons a day. In addition additions and improvements will be made in the company's present byproduct facilities.

The government-owned byproduct coke plant at Morgantown, W. Va., has been leased for a five-year period by the Sharon Steel Co. It consists of 74 ovens and is equipped to produce various products from coke gas.

### NOMINATIONS OPEN FOR JOHN WESLEY HYATT AWARD

ANNOUNCEMENT has been made by William T. Cruse, secretary of the award committee that nominations are open for the 1945 John Wesley Hyatt Award for outstanding achievement in the plastics industry. The award sponsored by Hercules Powder Co., consists of a gold medal and $1,000. It was created five years ago to honor the individual who, in the opinion of the judges, has made an outstanding contribution to the plastics industry during the preceding year. Members of the award committee are Richard F. Bach, dean of education, the Metropolitan Museum of Art; William Iler Beach, chief plastics engineer, North American Aviation, Inc., and 1944 medalist; Neil O. Broderson, president, Society of the Plastics Industry; Bradley Dewey, president American Chemical Society; Charles F. Kettering, vice president in charge of research, General Motors Corp.; Dr. Edward R. Weidlein, director, Mellon Institute; Dr. Gerald Wendt, editorial director, *Science Illustrated*; and William T. Cruse, committee secretary.

### BURCHFIELD RECEIVES AWARD OF CHICAGO RUBBER GROUP

FIRST prize of $1,500 has been given by the Chicago Rubber Group of the American Chemical Society, to Harry P. Burchfield, a research chemist at the Naugatuck Chemical Division of the United States Rubber Co. for devising the best method to differentiate natural rubber from the various synthetics in sorting out scrap for the production of reclaimed rubber. While the field was monopolized by natural rubber, reclaiming plants had no difficulty in separating different types of basic natural rubber. The growing use of GR-S and other synthetics which must be reclaimed by varying methods, created a sorting problem.

The test developed by Mr. Burchfield is based on the discovery that paper impregnated with special chemicals, will develop characteristic colors when exposed to smoke from different types of rubber branded with a hot iron. For example, the smoke from a GR-S tire will turn the paper green, but smoke from natural rubber will turn it blue. Similarly oil-resisting synthetic GR-S will produce a characteristic red color.

### SURVEY OF NUCLEONICS AT ACS ANNUAL MEETING

SESSIONS dramatizing the impact of atomic power upon civilization will feature the 109th national meeting of the American Chemical Society which will be held in Atlantic City, April 8 to 12. The meeting, the first to be held by the Society since 1944, is expected to be the largest in the history of the American chemical profession.

The program will include a broad survey of nucleonics under the chairmanship of Dr. Glenn T. Seaborg, co-discoverer of plutonium and also of elements 95 and 96. Dr. Seaborg, a University of California chemistry professor, is in charge of plutonium research for the Manhattan Project at the University of Chicago Metallurgical Laboratory.

Nuclear power's far-reaching implications for mankind will be emphasized by an exhibit, the first of its kind ever staged, on the harnessing of this new form of energy, its use in the atomic bomb and its potential service in science and industry.

Peacetime applications of many other war-

time advances will be discussed. Developments in plastics, petroleum, rubber, food, gas and fuel, medicinal chemistry, education and other fields will be reported in the several hundred papers to be presented at sessions of seventeen of the Society's professional divisions. More than 100 local sections of the Society will be represented.

## POLICY RECOMMENDATIONS FOR SYNTHETIC RUBBER

ASKED last year by the Office of War Manpower and Reconversion to submit recommendations for the future of the domestic synthetic rubber industry, the Interagency Policy Committee on Rubber submitted broad policy recommendations to OWMR on March 12. The committee also promised to offer a supplementary report containing detailed proposals intended to carry out these recommendations.

In its initial report the committee filed recommendations for the short term period of 1946 and 1947 when the supply of natural rubber is expected to be short of demand. These include continuation of international pooling and allocation of natural rubber; maintenance of government control over rubber beyond June 30, 1946; continuation of all but least efficient synthetic rubber plants in operation or standby condition until natural rubber becomes in ample supply; government ownership and operation of sufficient rubber capacity until private industry takes over; enlargement of natural rubber stocks in the United States.

Among long-range recommendations are continuous maintenance in production and use of synthetic rubber capacity to meet at least one-third of our total rubber needs, which involves the consumption of about 250,000 tons per year of general purpose synthetic rubber; maintenance by government as standby capacity of such efficient general purpose synthetic rubber plants as are in excess of capacity needed for the minimum program unless such plants are bought by private industry; private ownership and operation of the synthetic rubber industry should be the primary objective.

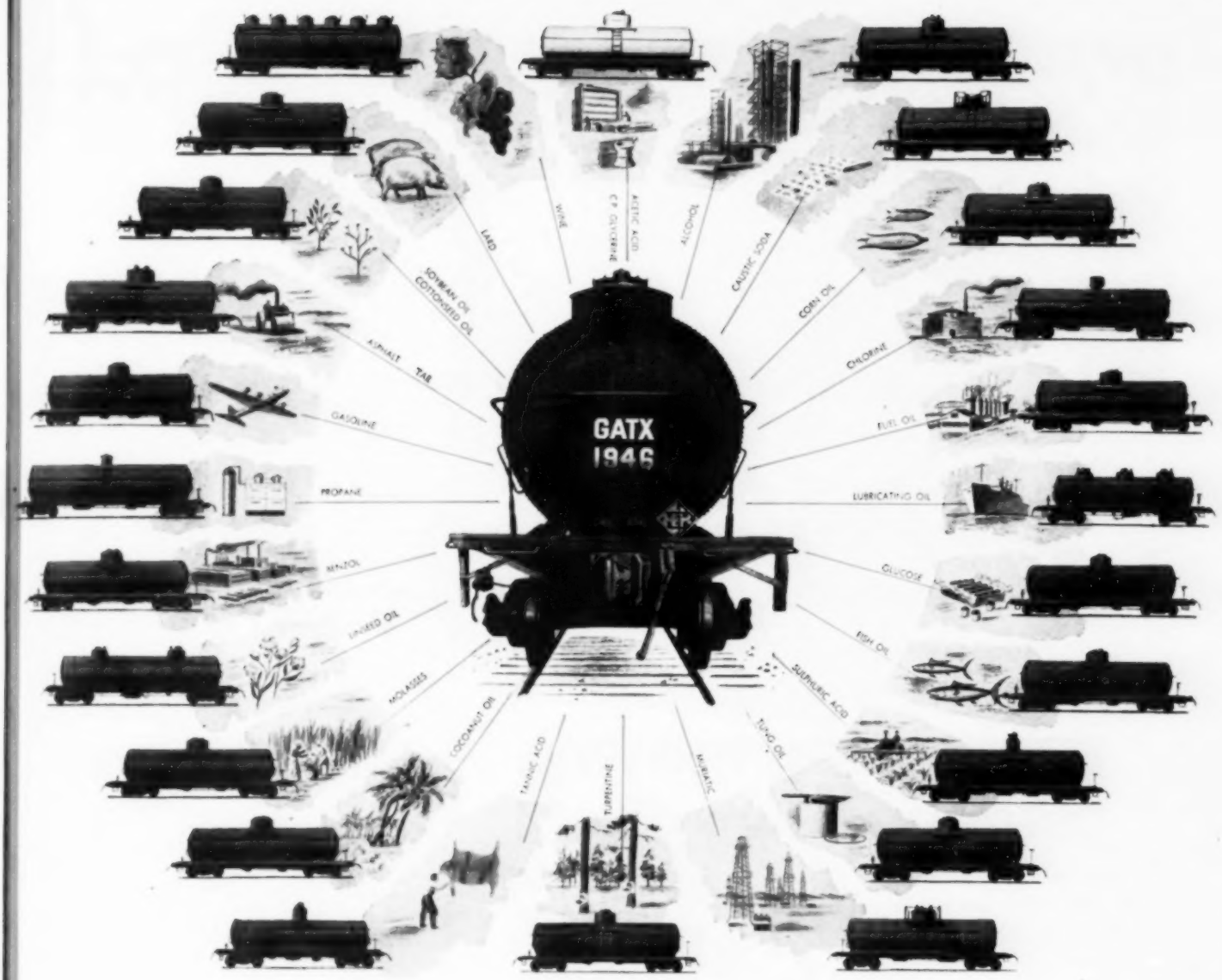
## MAURICE HOLLAND HONORED BY RESEARCH INSTITUTE

THE first Honorary Fellowship awarded by Industrial Research Institute, Inc. was conferred upon Maurice Holland, Industrial Research Adviser of New York, at the winter meeting of the Institute held last month in Columbus, Ohio. Mr. Holland, originator of the Institute, was for many years director of the division of engineering and industrial research, National Research Council. The by-laws of the Institute provide for the election of a limited number of honorary fellows in recognition of outstanding contributions in the field of industrial research or the rendering of exceptional and meritorious service to the Institute.

Over one hundred research directors and other industrial executives attended the two day meeting and discussed common problems of research management. Mr. Holland addressed the group on the influence of business cycles on industrial research trends. M. R. Budd, assistant director of advertising, Hercules Powder Co., Wilmington, discussed the ways in which advertising and research may collaborate. R. J. Short, chief engineer, engineering division, the Procter & Gamble Co., Ivorydale, Ohio, presided over a forum on recent adjustments of salaries and wages of research personnel.

At a series of round-table conferences, members of the Institute discussed the qualifications believed to be important to success in industrial research and methods and tools which might be useful in determining whether a candidate has these qualifications. M. G. Shepard, development manager, Naugatuck Chemical division of U. S. Rubber Co., Naugatuck, Conn., and chairman of

**To avoid a two-day shutdown while a periodic cleaning and repair of its boiler plant was in progress, International Minerals & Chemical Corp. leased a switch engine and connected its boiler to the steam pipes of the Rossford, Ohio, plant and thus permitted an uninterrupted production of monosodium glutamate. Shown inspecting the portable steam supply for the Amino Products Division are (left to right) Al Roeske, master mechanic; Carl Crane, resident manager; and Charles L'Hommedieu, superintendent**

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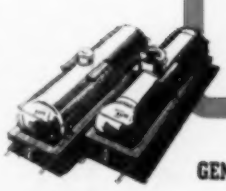

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the Institute's committee on education, selection, training and rating of research personnel, organized and conducted this session.

Clyde Williams, director, Battelle Memorial Institute, Columbus was guest speaker at an informal dinner session. He described Battelle and its work and told some of his interesting personal experiences in industrial research.

### M.I.T. ESTABLISHES RESEARCH ON USE OF PLASTICS

LONG-RANGE research which will improve service to the public by providing guidance for wiser applications of plastics in consumer products has been started at the Massachusetts Institute of Technology, it has been

## CONVENTION CALENDAR

**American Gas Association, conference on industrial and commercial gas, Commodore Perry Hotel, Toledo, Ohio, March 29-30.**

**American Institute of Chemical Engineers, regional meeting, Rice Hotel, Houston, Tex., March 31-April 3.**

**American Management Association, conference and packaging exposition, Public Auditorium, Atlantic City, N. J., April 2-5.**

**Midwest Power Conference, annual meeting, Palmer House, Chicago, Ill., April 3-5.**

**American Chemical Society, 109th meeting, general headquarters, Hotel Claridge, Atlantic City, N. J., April 8-12.**

**The Electrochemical Society, Inc., national meeting, Tutwiler Hotel, Birmingham, Ala., April 11-13.**

**First National Exposition of the Plastics Industry, sponsored by The Society of the Plastics Industry, Grand Central Palace, New York, N. Y., April 22-27.**

**American Ceramic Society, 48th annual meeting, Hotel Statler, Buffalo, N. Y., April 28-May 1.**

**National Association of Corrosion Engineers, annual meeting, President Hotel, Kansas City, Mo., May 7-9.**

**American Association of Cereal Chemists, annual meeting, General Brock Hotel, Niagara Falls, Ont., Canada, May 13-16.**

**American Oil Chemists' Society, annual meeting, Roosevelt Hotel, New Orleans, La., May 15-17.**

**National Foreign Trade Week, sponsored by Chamber of Commerce of the United States, Washington, D. C., May 19-25.**

**Metal Powder Association, spring meeting, Waldorf-Astoria Hotel, New York, N. Y., June 13.**

**Society for the Promotion of Engineering Education, 53rd annual meeting, Jefferson Hotel, St. Louis, Mo., June 20-23.**

**Fourth National Chemical Exposition, Chicago, Ill., September 10-14.**

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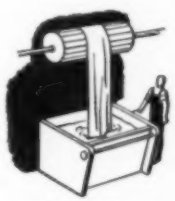
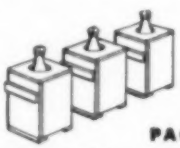


**IN TEXTILE MANUFACTURE . . .**
For carbonizing wool

**IN COSMETIC MANUFACTURE . .**
As an astringent in preparation of deodorants



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announced by the Plastic Materials Manufacturers Association, Inc. The work at M.I.T. will be under the supervision of Prof. A. G. H. Dietz, of the department of building engineering and construction. Research will deal with the fundamental engineering properties of plastics and, if necessary, will set up new test methods, similar to those now available for other structural materials, according to W. Stuart Landes, president of the plastics association.

It is the aim of the M.I.T. research to correlate physical properties with chemical composition, but none of the research will be aimed at development of new plastics. Only plastics now in existence or which will become commercially available will be studied, and results of such research will be published in scientific journals, with data made available for industrial laboratories of participating companies while the research is in progress.

Representing the plastics association on the steering committee for the project will be Dr. D. S. Frederick, vice president of Rohm and Haas, Philadelphia. Assisting Dr. Frederick from P.M.M.A. will be Harold W. Paine of the E. I. du Pont de Nemours & Co. Inc., John H. Adams of Bakelite Corp., W. C. Goggin of the Dow Chemical Co., Howard J. Nason of Monsanto Chemical Co. and L. W. A. Meyer of Tennessee Eastman Corp.

### TANNING RESEARCH PROGRAM AT CINCINNATI

A NEW long-term fundamental research program for the War Department and National Academy of Science is being arranged at the University of Cincinnati. The program, dealing with the chemistry of skins and the tanning of leathers, is so extensive that Ohio State and several eastern and midwestern institutions have been invited to share in the work. The research will be under the direction of Dr. Fred O'Flaherty, professor of applied science in tanning and director of the University of Cincinnati leather research laboratory which is maintained by the Tanner's Council of America.

### WOOD CHEMICALS PRODUCTION WILL BE EXPANDED

COORDINATION and development of seven wood chemical companies in the northwestern Pennsylvania territory are being carried out by the Susquehanna Chemical Corp. which maintains general offices at Bradford, Pa., and administrative and sales offices at 247 Park Ave., New York. The companies, all in Pennsylvania, which will operate as divisions of the parent corporation include Clawson chemical division at Hallton, Custer City chemical division at Custer City, Crosby chemical division at Crosby, Genesee chemical division at Genesee, Gray chemical division at Roulette, Norwich refinery division at Smethport, and Union charcoal division at Westline.

Phillip C. Crowen, president of the corporation, who is located in the New York office, stated that first consideration will be to bring the individual divisions up to their fullest possible production. Whether this

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means more or better equipment, enlarging plant facilities or employing more men, any or all of the things needed will be done in a logical manner to meet an aggressive sales program now being developed. Sales will be under the direction of Stephen P. Kelly, executive vice president who formerly was associated with William S. Gray & Co.

C. R. MacFarland, secretary and treasurer of the corporation, is in charge of the operational headquarters at Bradford. L. A. Schlueter, formerly of the Koppers Co., has been appointed production manager for all plants. Chester Burt of Smethport will have charge of all wood operations.

### ALLIED CHEMICAL & DYE BUILDS LABORATORY

Construction work is in progress near Morristown, N. J., on a large modern laboratory for Allied Chemical & Dye Corp. The new research facility will embody the latest features in laboratory design and equipment and will cost about $1,000,000. The new laboratory will occupy a site acquired several years ago but building was deferred because of wartime controls. It will house the central research organization whose activities are directed toward fundamental and exploratory research in various fields of chemistry and supplement the extensive research conducted by the several operating subsidiaries and divisions of Allied.

### U. S. RUBBER WILL EXPAND CHEMICAL FACILITIES

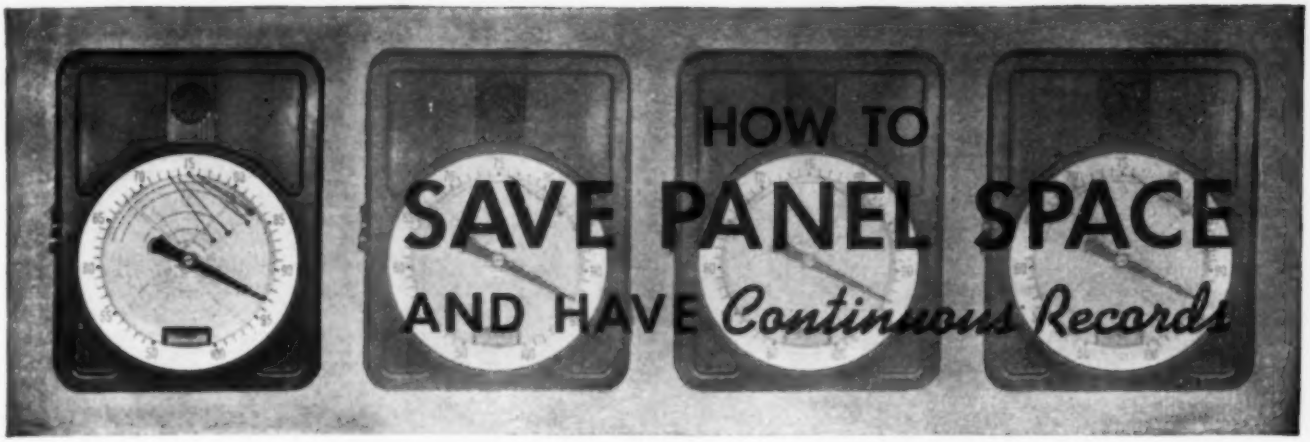
To transform the knowledge of chemicals gained during wartime into products of increased quality for industrial and civilian use, more than $2,000,000 will be spent to expand the facilities of the Naugatuck Chemical division, United States Rubber Co., at Naugatuck, Conn., it is announced by Herbert E. Smith, president of the company. This plant expansion is part of a three-way program to meet the increased demands for rubber chemicals, latex, dispersions and agricultural chemicals; for the production of new plastics with almost unlimited industrial and commercial applications; and to further general scientific research.

### INSTRUMENT MEN IN TEXAS FORM SECTIONAL SOCIETY

Men in the area surrounding Corpus Christi, Tex., who work with and are interested in all types of control and measuring instruments have formed the South Texas Instrument Society. It is expected that the new group will become an affiliate of the Instrument Society of America, a recently formed national society of control and measurement engineers. J. G. Pratt of Corpus Christi is president of the Texas group.

### DU PONT ADDS TO AWARDS FOR UNIVERSITY FELLOWSHIPS

The E. I. du Pont de Nemours & Co. has announced plans to award more than twice as many university fellowships this year as in 1945. The chemical industry today is facing a serious shortage of chemists, physicists, and engineers with advanced training. To help meet this problem the

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Du Pont plan provides for forty-one post-graduate fellowships in chemistry, five in physics, fifteen in chemical engineering and seven in mechanical engineering. Six post-doctoral fellowships in chemistry also are included in the enlarged fellowship program.

In 1945, 35 fellowships at 29 universities were offered, as compared with this year's program of 74 awards to 45 universities. The fellowships in mechanical engineering the being offered for the first time this year. It is believed that the expanded fellowship plan will encourage more students to undertake post-graduate work.

Each post-graduate fellowship provides $1,200 for a single person or $1,800 for a married person.

## POPE AND SOULE ADDRESS AMERICAN SECTION OF SCI

WITH Francis J. Curtis, vice president of Monsanto Chemical Co., presiding, the American Section of the Society of Chemical Industry held a meeting on February 21 at Hotel Biltmore, New York. The principal speakers were Col. Allan M. Pope, president of the First Boston Corp., Boston, Mass., and Roland P. Soule, vice president in charge of research and development, American Machine & Foundry Co.

Colonel Pope discussed the inter-relationship between banking and the chemical industry. He devoted a part of his talk to the question of American investments in business enterprises in foreign countries. He said that if a well-organized American-staffed, limited company is organized in a proper area abroad with American dollars to build it and it is controlled by a parent company in America but substantially owned by local interests and purchases with local currency in full or in part, you can have a well run company employing local labor. He believed that under such a set-up you would get fair tax treatment and avoid confiscation.

Mr. Soule discussed what he termed the problem children of technology and banking. He paid tribute to the technologist for contributing the major share to the great rise in our standard of living and to the banker for supplying the capital which translated the plans of the technologists into industrial realities. He then touched on the problems created by technological developments and of one of these problems he said:

"First, technology has committed us to an economy of ever-expanding production and constant growth. Recall, if you will, that our material progress has been won through increasing efficiency in the utilization of men and materials. We have spent more and more money each year to find new and better ways of getting along with fewer and fewer workers. That is all right because that is the only way we can all have more and still work less. But the corollary should be equally clear. If we are always to have full employment while deliberately reducing the labor required to make each unit of output, we must always increase the number of units we are producing. Whether or not our exports rise, we must always have expansion in our total output. Normal business in any technological economy is not a flat level but a line pitched sharply upward. The alternative to expansion is not stability. It is unemployment, depression, and social upheaval. We cannot let loose the force of technology and at the same time abandon further growth."

# PACIFIC PROCESS INDUSTRIES

## TRENDS • EVENTS • DEVELOPMENTS

JOHN R. CALLAHAM, Pacific Coast Editor, San Francisco, Calif.

### NEW FORMALDEHYDE PLANT STARTS OPERATIONS

After construction delays caused by flood conditions, the new formaldehyde plant of Casein Co. of America at Springfield, Ore., is now getting into full production. This plant, which will be the largest producer of formaldehyde in the West, is reported to have a capacity of 500 tons monthly. Largest single outlet for the product will be in phenol-formaldehyde resins for use in waterproof adhesives for the Douglas fir plywood industry of the Pacific Northwest.

Installation of resin kettles and other equipment at the firm's new adhesives plant at Springfield is being completed, and this unit is expected to start operations during May. Output from this plant, which will largely be phenolic resins for plywood, will supplement the firm's present adhesives plant in Seattle. C. S. Leonardson, with headquarters in Seattle, is western manager of Casein Co. of America.

### BAY REGION SOAP PLANT BEING ENLARGED

With intentions of manufacturing a large line of toilet goods such as shaving creams and similar articles, the Colgate-Palmolive-Peet Co. is adding a five-story factory building to its present soap plant in Berkeley, Calif. Construction on the new unit, which is expected to cost approximately $1,000,000 with equipment and machinery, began last autumn but has been delayed because of materials and labor shortages. In addition to providing facilities for manufacturing toilet goods formerly made only in the East, the modern design structure will provide additional office space for the firm. Colgate's Berkeley factory has been turning out a line of heavy-duty, household and toilet soaps since 1915 and is one of the largest soap plants in the West. M. R. Dickinson is chief chemist, while C. A. Altman is plant superintendent. B. W. Railey is vice president in charge of western activities of the firm, with headquarters in San Francisco.

### INSTRUMENT FIRM INCREASES PRODUCTION FACILITIES

With production of the new model infrared spectrophotometer well under way and with a large increase in domestic and foreign requirements for the firm's other spectrophotometers and pH meters, the National Technical Laboratories of South Pasadena, Calif., has found it imperative to increase facilities for manufacturing and research. A new three-story building, expected to cost approximately $160,000 with equipment, will constitute a considerable increase in manufacturing space and will also relieve crowded conditions in the research and development department. This construction, expected to be completed by mid-summer, is one of several steps currently being taken by the firm to increase production and to provide additional facilities for development of new products. Concurrently, increases are being made in the production and research staffs. Dr. Arnold O. Beckman is president of the firm.

### RUBBER UNIT CONVERTS TO CONTINUOUS POLYMERIZATION

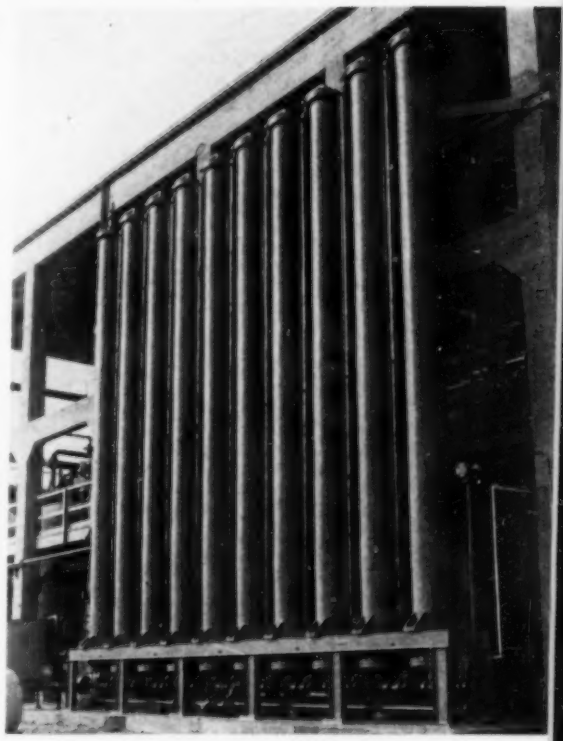
Abandoning the batch-wise system of polymerization originally established for production of GR-S synthetic rubber, the government-owned Los Angeles plant operated by Goodyear Synthetic Rubber Corp. has now been completely converted to continuous polymerization, thus becoming the second plant of its kind to be so converted. The improved system of manufacturing synthetic rubber was developed by Goodyear under Rubber Reserve approval and cooperation, and in early 1945 Goodyear's two-unit plant at Houston was the first of the government units to switch to continuous polymerization.

In batch-wise operations, the individual components of butadiene, styrene, soap solution, water and catalyst solution were charged through individual meters into glass-lined temperature-controlled reaction vessels. In the continuous system used at Los Angeles, these components are fed continuously by individual proportioning pumps, or metering equipment, through a reactor chain consisting of the originally installed reactors hooked in series groups of twelve. The usual temperature control is applied to the latex as this flows through the series.

A group of ten displacement tubes having a combined volume approximately equivalent to one reactor has been added in the series following the twelfth reactor. Provision has been made for addition of the stopping agent in the last few reactors or in any of the ten tubes, the latter providing means for closer control of the reaction "stoppage" point. "Stopped" latex flows continuously from the reactor and tube series into the recovery system for removal of excess butadiene and styrene. Only solution preparation and polymerization methods and equipment have been converted to the continuous basis, leaving unchanged the remaining process steps comprising standard plant operations.

### SHELL PLANS ASPHALT PLANT FOR PACIFIC NORTHWEST

Plans for an asphalt plant at Willbridge Terminal in Portland, Ore., with a tentative midsummer 1946 completion date, were recently announced by Shell Oil Co., Inc. Charging stock for operation of the plant will be supplied by tank ship from the firm's Martinez refinery, requiring installation of pipelines, storage tanks and pumps at Martinez, Calif., and bringing the total expenditure for the enterprise close to $300,000.



**These ten displacement tubes are connected in series following the twelfth reactor of the synthetic rubber plant operated by the Goodyear Synthetic Rubber Corp. at Los Angeles. This plant was second of its kind to convert to continuous polymerization**

Contract for building the Portland plant, which calls for installation of a furnace, vacuum fractionating column, pumps, heat exchangers, cooling equipment and tankage, has been let to Bechtel Bros. McCone Co.

The new plant will have a capacity sufficient to serve the Pacific Northwest and will make available a complete line of asphalts carried in stock in Portland. It will be possible to ship tank-car lots of hot asphalt on short notice from that city to any point in the territory at a considerable saving of running time and retention of heat in the oil. Asphalt now shipped by rail from Martinez requires up to a week in transit.

### VARNISH-GRADE RESINS NOW PRODUCED FROM COAL

In a pilot plant near Huntington, Utah, varnish-grade fossil resins are now being recovered from high-resin bituminous coal at the rate of about one ton of resin from 20 tons of coal daily. It is expected that operations will soon be expanded to a semi-commercial scale in the same unit by treating 100 tons of coal and recovering 5 tons of resins per 24 hr. The process, developed by Adrian Nagelvoort of Huntington, Utah, and previously described in *Chem. & Met.* (Oct. 1942, pp. 80-82), continuously separates the fossil resins or copalite from coal fines by sink-and-float principles. The treatment reduces sooting of the coals.

Resins recovered from the coal are further treated to give three constituents—a wax,

an asphalt-like resin and a light, amber resin. Little use has been found for the wax, but the asphaltic resin can be used for dark varnishes while the clear resin will give a product reported to be comparable in quality with spar varnish. This resin has little or no odor on burning and is soluble without running. When dissolved in varnish oils, it is reported to leave no residue, thus eliminating the steps of filtering and settling. The amber resin, soluble in synthetic rubber, is compatible with other natural and synthetic varnish resins.

Approximately one car of resins is being shipped monthly to a large eastern firm for use in varnish-making, but Nagelvoort hopes eventually to treat all Huntington Canyon coals, which average about 5 percent resin content. Present output is about 1,200 tons daily, but this is expected to rise to some 2,000 tons. The clarified resin, it is claimed, can compete in price with any natural resin now imported.

## NEW CULTURE MEDIUM FOR ANTIBIOTICS DEVELOPED

RESEARCH in the possible utilization of asparagus waste as a culture medium for certain micro-organisms has recently been carried on at the Western Regional Research Laboratory, Albany, Calif. Concentrated in a relatively few localities, the waste accumulation each season at food processing plants probably totals well in excess of 50,000 tons. Experiments prove that processed butt juice is a useful medium for culturing bacteria and molds that produce antibiotic compounds such as penicillin and subtilin, and for a bacterium that produces the proteinase enzyme used in the brewing industry for the chill proofing of malted beverages and in the leather industry for the bating of hides.

Experimental processing of waste juice during the past four seasons has been in cooperation with several canneries on a pilot-plant scale. One batch of approximately 6,000 lb. was produced at Stockton, Calif., with commercial or semi-commercial equipment. No commercial supply has yet become available because of lack of processing equipment and labor. Laboratory estimates, however, indicate that the culture concentrate can be produced for approximately 7c. per lb.

**Pacific Northwest Electric Energy Generation and Consumption[1]**

| Calendar Year | Energy Generation (1,000 K.w.h.) Pacific Northwest[2] | Bonneville[3] | Energy Consumption (1,000 K.w.h.)[4] Non-Ferrous Metals[5] | Chemicals[5] |
|---|---|---|---|---|
| 1940 | 6,859,392 | 374,170 | 514,000 | 149,800 |
| 1941 | 8,582,708 | 1,667,237 | 1,643,000 | 208,000 |
| 1942 | 11,391,025 | 4,133,048 | 3,167,000 | 391,900 |
| 1943 | 14,884,232 | 7,361,403 | 5,919,000 | 789,500 |
| 1944 | 16,326,000 | 9,590,257 | 6,147,000 | 886,000 |
| 1945 | ..... | 7,912,253 | 4,355,000 | 900,000 |

[1] Bonneville Power Administration, Rates & Statistics Section. [2] Including the state of Idaho, Oregon and Washington. [3] Generated at Bonneville and Grand Coulee for Bonneville Power Administration. [4] Non-ferrous metals and their products for the states of Idaho, Oregon and Washington. [5] Chemicals and allied products in the state of Idaho, Oregon and Washington. [6] Data estimated from report by Federal Power Commission and deliveries by Bonneville Power to these industries.

## ELECTROCHEMICAL INDUSTRIES THRIVE IN NORTHWEST

REFLECTING the rapid growth of the chemical and allied products industries in the Pacific Northwest is the six-fold increase in electric energy consumption in these industries during 1945 as compared to 1940. According to recent figures from Bonneville Power Administration, energy consumption for the chemical group increased slightly for 1945 while that for the non-ferrous metals group declined almost one-third from the high of 1944. The accompanying table shows the trend in electric energy generation and consumption for the area.

## SYNTHETIC ZEOLITE PRODUCER SWITCHES FROM SILICA GEL

Now fully reconverted from wartime production of silica gel, the San Bernardino, Calif., plant of Culligan Zeolite Co. is turning out maximum production of synthetic gel-type zeolites for water softening purposes. At the outset of the war, the firm was requested by the U. S. Government to increase production of strategic silica gel since this material could be made by a process somewhat similar to that used at the plant for manufacturing gel zeolites. Culligan's California plant then became the second largest producer of silica gel in this country and the only one using solar evaporation rather than artificial heat for drying.

Having discontinued the manufacture of silica gel, the plant is now using solar evaporation in the production of zeolite, which can be made from the reaction of sodium silicate and aluminum sulphate, careful washing to remove excess soluble salts and finally slow dehydration by solar evaporation. This method, it is claimed, preserves the reticular structure of the gel and thus increases softening capacity by increasing the effective capillary surface area. The final product, a hydrated aluminosilicate containing easily exchangeable sodium ions and having the general formula $Na_2O \cdot Al_2O_3 \cdot 5\ SiO_2 \cdot xH_2O$, is said to have 3-5 times the softening capacity of greensands or natural zeolites.

**Using solar evaporation for dehydration, this plant of the Culligan Zeolite Co. at San Bernardino, Calif., is the only West Coast producer of synthetic gel-type zeolite**

## KAISER TO LEASE ALUMINUM PLANTS NEAR SPOKANE

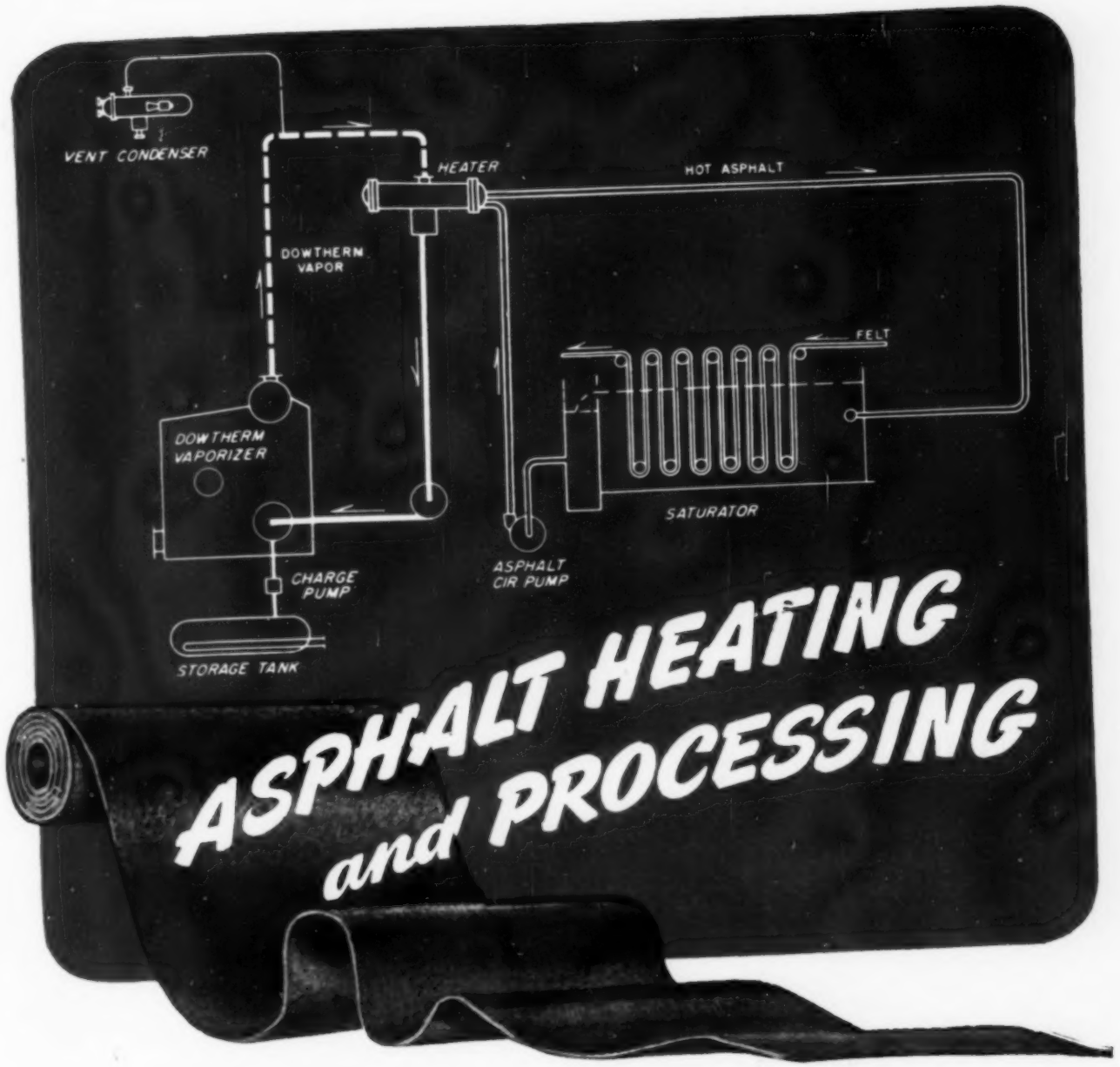
UNDER terms approved by RFC, Henry J. Kaiser Co. offered during mid-February to lease the Trentwood, Wash., aluminum rolling mill and the Mead, Wash., aluminum reduction plant, both of which were operated by Aluminum Co. of America during the war. Aluminum sheet would be produced at the Trentwood mill, a large part of which is expected to go into car bodies, Kaiser stated. The Mead plant has an annual capacity of 96,000 tons of aluminium ingot, while the Trentwood mills have a design capacity of 144,000 tons of sheet a year.

The Trentwood plant has been leased by Kaiser-Frazer Corp. and Mead by Kaiser Cargo, Inc., each for five years. The Trentwood agreement is terminable by the lessee at the end of the first year or the end of any subsequent year after prior written notice. The Mead agreement is terminable by the lessee after the end of the second year at any time after prior written notice. These leases, which place a third producer in the primary aluminum industry, are subject to approval by the attorney general. Such approval is believed likely to be given.

## PLASMA PROTEINS PRODUCED COMMERCIALLY BY CUTTER

PROTEINS from human blood plasma, now being made generally availiable for the first time, are produced commercially in this country solely by Cutter Laboratories, Berkeley, Calif., also the only producer of penicillin in the West. Using the Cohn process of fractional precipitation developed during 1942 to supply critical albumin and other plasma fractions to the armed services, Cutter now produces five blood-derived protein therapeutic agents. The entire process of plasma fractionation is based on the fractional precipitation of closely related proteins from alcohol-water septems with accurate control of pH, temperature and alcohol content. Most separations are carried out at about —5 deg. C.

Commercial products now being made by Cutter Laboratories from human blood plasma are albumin, a small-bulk substitute

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### NEW OXYGEN PLANT NOW OPERATING IN UTAH

With completion of the new manufacturing unit of the Acetylene Co. of Utah, the first independently owned oxygen plant in Salt Lake City is now in operation. The plant has a daily capacity of 90 cylinders of 250 cu. ft. capacity each; the product is 99.5 percent pure. A new electric power substation has also been completed to supply current to operate pumps necessary for air liquefaction and for the distillation process used to purify the liquid oxygen. The firm also has an acetylene plant in Salt Lake City which has operated since 1941. Don S. Jenkins, Salt Lake City, is manager of the new plant.

### MODERN SUGAR PLANT FOR IMPERIAL VALLEY

What is reported to be probably the most modern and streamlined beet sugar plant in the West is now under construction by Holly Sugar Corp., Colorado Springs, Colo., at Imperial, south of Brawley, in California's Imperial Valley. The plant will cost $3,000,000 and is reported to have a daily slicing capacity of about 2,500 tons, equivalent to 250-300 tons of sugar. Among the various new processing improvements to be incorporated in the plant is a battery of Silver continuous diffusers to replace batch-operated tanks.

This new factory will bring to 13 the number of beet sugar plants operated by Holly in Colorado, California, Montana and Wyoming. Other plants in California are at Alvarado, Hamilton City, Santa Ana and Tracy. A. L. Cooper is chief engineer of Holly Sugar Corp., while V. I. Morris is construction superintendent.

### LIQUID SULPHUR DIOXIDE IMPROVES CROP YIELDS

A recently patented method of applying liquid sulphur dioxide to highly alkaline soils is reported to be resulting in rapid improved growth and quality of crops by unlocking plant foods in soils and fertilizers. Full-scale experiments conclusively show increased yields in potato and alfalfa crops. Sugar beet yields increased by 6.5 tons per acre, with a higher sugar content. Conclusive tests have not been made on Southern California's citrus groves, but the new method appears to be effective. Unlike sulphur dioxide, ordinary soil sulphur used for surface applications in citrus groves takes from one to five years for moisture, heat and bacteria to effect the required changes.

Developed by Del Alvos of Guadalupe, Santa Barbara Co., Calif., the process consists of spraying liquefied sulphur dioxide directly into irrigation water before each

crop is planted and sometimes after roots are formed. The sulphur dioxide forms sulphurous acid and the pH of the water can thus be reduced to as low as 3.0. The treatment was first tested on the potato lands of Stanley Germain of Glendale, who is now in charge of the project. Equipment required for expanding operations was unobtainable until the war ended and only large-scale treatments can be undertaken for the present. A new plant is now being completed at Bakersfield and a second is to be built at Salinas, Calif.

### GUAYULE RUBBER PROJECT TO BE ANNOUNCED

PLANS to destroy 5,500 acres of guayule plants in the Salinas Valley, Calif., and to return the land to owners from whom the government leased it, were announced recently by the U. S. Forest Service. Owners were given the alternative of taking possession of their lands now and either keeping or destroying the rubber plants, or allowing the government to remove the plants and release the land June 30. Owners not wishing to claim their lands now will receive rent on the land plus an additional $3 per acre until that date. Cost of removing the plants was estimated at from $2.25 to $6 per acre, depending on the method used.

### LARGE INSECTICIDE PLANT UNDER CONSTRUCTION

IN ORDER to help supply the increasing West Coast demand for insecticides, fungicides, and allied chemical sprays and dusts for agricultural purposes, the Food Machinery Corp. of San Jose, Calif., has announced that its subsidiary company, the Niagara Sprayer & Chemical Co., Inc., is erecting a new $450,000 chemical plant and office at Richmond, Calif. Ground-breaking for the first units was begun in early January, and these are expected to be completed during May. These initial units will occupy approximately 35,000 sq. ft., but provisions have been made to substantially triple the plant in the near future.

Long regarded as a leading manufacturing firm in the insecticidal field, activities of Niagara Sprayer & Chemical Co. have been in the past primarily confined to the Eastern United States. The firm has manufacturing plants at Middleport, N. Y., Jacksonville, Fla., New Orleans, La., Harlingen, Tex., and Burlington, Ont. The California plant will produce insecticides and fungicides especially designed to meet the requirements of agricultural conditions of any particular area west of the Rockies.

### COLORADO MAPS INDUSTRIAL RESEARCH PROGRAM

DEVELOPMENT of new processes and products for industry in Colorado and a wider utilization of the state's resources is the basis of a program undertaken by the Colorado Board of Industrial Development Research. The board is composed of the heads of the University of Colorado, Colorado A. and M. College and Colorado School of Mines. The program was established by a legislative appropriation of $100,000 for a two-year period.

Research on use of animal wastes as a possible source of certain hormones and other


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drug products is being developed, as well as research into uses for fruit and vegetable wastes and culls. Other projects in process include resin impregnation of native timber, production of basic organic chemicals by the hydrogenation of coal, and a study as to the practicability of establishing leather tanning and glass manufacturing plants.

### INDUSTRIAL RESEARCH UNIT FOR OREGON STATE

SITE for erection of an Industrial Building for Oregon State College has been obtained just off the campus at Corvallis. Construction will begin as soon as detailed plans and materials are available, with tentative completion date set for early in the 1946-47 school year. Cost is estimated at approximately $100,000 without equipment, which it is hoped will be provided by industrial concerns interested in the research to be conducted.

The structure will be a factory type with a maximum floor space, large doors to accommodate trucks and a craneway to serve the entire building. Part of the space will be devoted to a Forest Products Laboratory where large-scale research will be conducted in utilization of wood waste. Remainder of the area will be used for industrial research of various kinds, space being provided for electric furnace operations, electrowinning cells, crushing and grinding operations and general concentrating and metallurgical pilot plant equipment.

### WYOMING BENTONITE OUTPUT CONTINUES TO RISE

ALTHOUGH recent figures are not yet available, indications are that the output of bentonite from Wyoming has continued to increase over the 159,250 short tons of 1943, which was a 100 percent increase over 1939. In the later year, Wyoming was the leading producing state with 33 percent of the national total. In addition, new uses are constantly being developed for this clay. A project is now under way at the Natural Resources Research Institute of the University of Wyoming, Laramie, to make a thorough examination of Wyoming bentonites and related clays with the object of evaluating them for their best uses and possibly developing new outlets.

A recently completed expansion program has increased by 50 percent the capacity of the modern bentonite processing plant of the Baroid Sales Division of National Lead Co. at Osage, Wyo. This plant is surrounded by deposits of bentonite extending over a distance of 30 mi. Output of the American Colloid Co. at Upton, Wyo., and Belle Fourche, S. D., and of the Eastern Clay Products Co. at Belle Fourche has also been increased to meet industrial demands for this versatile clay.

### VAN CAMP PIONEERS SYNTHETIC ORGANIC MEDICINALS

IN RECENT years, the Van Camp Laboratories at Terminal Island, Calif., has become the West's only major producer of bulk synthetic organic medicinals and a leading producer of biologicals. The products, chiefly used in medicine and nutrition, are made almost exclusively from fish and fish by-products and are largely the results of

pioneering work in this field by the firm's director, Dr. Sven Lassen. The origin of the Laboratories dates back to 1936 when Dr. Lassen was requested by Van Camp Sea Food Co. to develop a process for the recovery of vitamin A and D oils from the large supply of tuna livers available. Since 1938, when the vitamin processes were commercialized, many new developments have taken place and the Laboratory now employs approximately 100 persons.

Development work at Van Camp Laboratories has been almost exclusively devoted to products derived from fish. Chief products from the volume viewpoint are vitamin A and D oils for feed and pharmaceutical purposes, condensed fish solubles, a series of individual c.p. amino acids and amino acid digests for oral and intravenous feeding. Among the chemicals produced are cholic acid, dehydrocholic acid and sodium salt, *l*-tryptophane, *l*-histidine, *l*-cystine, histamine phosphate and cysteine hydrochloride. Further developments in this field of fish-derived chemicals are expected.

## RADICAL COAL CARBONIZATION PROCESS GOES TO PLANT

After some seven years of experimentation and pilot plant work, the patented low-temperature coal carbonization process developed by Coal Logs Co., Inc., Salt Lake City, is now ready for test production in a new semi-commercial plant in North Salt Lake City. Inventor of the basic process is K. L. Storrs, now president of the firm, while George W. Carter of the department of mechanical engineering, University of Utah, is chief engineer of the company. Extensive pilot plant tests have convinced these men that this low-temperature carbonization process for making smokeless fuel, unique in a number of features, is both technically and economically sound. As a result of an investigation of the process by the State of Utah over a period of two years, the firm is under contract with the state to operate the N. Salt Lake City plant, now over 90 percent completed, for the treatment of 50 tons of raw coal daily.

In the Coal Logs process, a thin layer of coal conveyed by vibratory means is heated continuously and thoroughly agitated in a horizontal rectangular retort. The travel rate and temperature are controlled so that immediately upon reaching a plastic or semi-plastic condition, the material is dropped into a simple continuous screw that applies a pressure of about 40 lb. per sq.in. and extrudes a smokeless, low-temperature coke in solid cylindrical form known as Coal Logs. The "log" briquettes are strong, coherent and homogeneous; they ignite as readily as raw coal. By keeping the finishing temperature above that necessary to reach a plastic or semi-plastic state, the product is delivered in granular form for us in stoker-fed appliances. The throughput time is about one minute during which the volatile content of Utah bituminous coal is reduced from about 40 percent to 18-22 percent. No binder is necessary.

One radical feature of the Coal Logs process is the manner in which the volatiles are removed immediately and continuously at the volatilization temperature of each major fraction rather than as a mixture of fractions in one removal step. The "fractionation" equipment simply consists of six

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or more air-cooled ducts leading directly from the retort at the proper temperature zones, in some cases being only 10-12 in. apart. This method of progressive distillation gives a series of relatively pure fractions of distinct physical and chemical properties, avoids carbonization and cracking of the products and results in considerable heat economy by avoiding superheating of volatiles. Average yield from one ton of Utah bituminous coal, based upon pilot plant data, consists of approximately 1,400 lb. of semi-coke, 23 gal. of oils and 1,200 cu.ft. of fuel gas having 1,000 B.t.u. per cu.ft. The manufactured gas supplies all heat energy required for the carbonization.

Outstanding advantages of the new low-temperature carbonization process have been summarized to be: (1) Revolutionary speed of production; (2) low fixed capital resulting from speed and efficiency of the carbonization, simplicity of equipment and operations, automatic and continuous processing and flexibility of process; (3) adaptability of the process to any coal for production of granular semi-coke and to any coal having suitable plasticity for low-temperature semi-coke "logs"; (4) number and purity of volatile fractions easily obtainable; (5) advantages of the solid fuel products of which the size, density and characteristics can be easily controlled. Company officials estimate that total investment for a Coal Logs plant would be 25-30 percent that for a plant of comparable capacity using other processes, while the process cost per ton of coal would be only 18-25 percent as much.

In addition to the semi-commercial, low-temperature carbonization plant, Coal Logs Co. is ready to operate at the University of Utah a pilot plant to produce continuously high-temperature, metallurgical-grade coke from a raw coal feed of about 200 lb. per hr. In this process, the low-temperature "logs" just described are simply pushed from the extrusion unit through a tube of larger diameter than the log and heated progressively until a discharge temperature of 1,700-2,000 deg. F. is reached. Several additional volatile fractions can be collected as in the low-temperature process, thus reducing the volatile content of the coke to as low as 2 percent. This treatment is expected to give 1,200 lb. of coke, 29.5 gal. of volatile condensates and 8,000 cu.ft. of 600-B.t.u. fuel gas per ton of Utah bituminous coal. Time required for production of one ton of coke by this process is estimated at 0.4 hr. in contrast with the 16 and 1.9 hr. respectively required by beehive and by-product coke ovens on a comparable basis.

### SUIT BROUGHT TO CANCEL POTASH LAND LEASES

Suit by the U. S. Government to cancel lease on thousands of acres of land near Trona, Searles Lake, Calif., has been filed recently against the American Potash and Chemical Co., one of the largest producers of potash and borax in the United States and also a large producer of lithium, bromine and certain sodium salts.

It is charged that the company misrepresented the ownership of its capital stock, of which 90.79 percent was German owned, and that it used its lease right to control prices and engage in a conspiracy for the restraint of trade. The company has filed an answer denying all charges.

# A BRIGHT LIGHT AT A DARK MOMENT

Stone Mountain Grit Co., Lithonia, Ga., faced with heavy demand for grit to increase egg production, was bottle-necked by slow packaging and a severe shortage of osnaburg bags. With a packaging crew of 14 men, production averaged only 150 one hundred lb. bags per hour from each of 4 spouts — a total of 600 bags per hour. 6 St. Regis packers to fill multiwall paper bags were installed, and operated in pairs. With a crew of 12 instead of 14 men, production went up to 200 bags per hour per machine — a total of 1200 bags per hour . . . from 60,000 to 120,000 lbs. per hour.

**Production Per Man Hour More Than Doubled**

With the St. Regis system, 12 men packed 120,000 lbs. per hour, or 10,000 lbs. per man hour; equivalent to 130% increase of output per man hour, and easier and pleasanter jobs for the entire crew.

**Container Costs More Than Halved**

The hard-to-get osnaburg bags cost him $150 per thousand. Multiwall paper valve bags cost him $68.40 per thousand. His container costs were reduced by 54.6%.

**Consumer Acceptance**

Sift-proof paper valve bags assured dust-free, full weight containers which customers readily accepted in place of the former fabric containers.

*(Left)* A pair of the St. Regis packers in the Stone Mountain Grit Co. plant at Lithonia, Ga.

*(Below)* Sift-proof Multiwall paper bags are handled easily.

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# NEWS FROM ABROAD

## SOUTH AFRICA PLANS EXPANSION OF WOOD PRESERVING AND OTHER CHEMICAL PROCESS INDUSTRIES

Special Correspondence

THE Minister of Agriculture of South Africa has announced that regulations will be issued making treatment against insect pests compulsory for all wood to be used for building. At present only a few commercial firms are equipped for the work, but a government depot near Cape Town soon will be ready to treat large stocks of poles. It will not compete with commercial firms, which will have ample time to prepare before the regulations come into force. Three processes will be used—creosote treatment in open tanks; creosote treatment under pressure; and treatment with pentachlorophenol preservative.

A considerable expansion of Southern Rhodesia's cement manufacturing industry and the possibility of establishing a factory at Gwanda are envisaged in investigations now being made by the Rhodesian Industrial Development Commission. The largest known limestone deposits in Rhodesia, suitable for the manufacture of cement, are situated 20 miles southeast of Gwanda on the main line to West Nicholson. About one-third of the deposits belongs to the Premier Portland Cement Co. of Bulawayo, which is working quarries on the property and is railing the limestone to Bulawayo. The remainder of the deposits belong to the Gwelo Land and Minerals Co., but the Industrial Development Commission has taken a year's option.

Research on the production of lubricating oils from torbanite oil was concluded by the Fuel Research Board, according to its annual report. Experiments were conducted on heavy oils produced from crude torbanite oil. The lubricating oils had better viscosity indices than those produced from the gas oil fractions, although the analysis indicated a higher percentage of aromatic rings. The most outstanding achievement resulting from the board's policy of concentrating on problems arising from the war was the completion of work on the design and testing of a gas producer for use on transport vehicles. This producer, designed to burn charcoal made from South African timber, was adopted by the government as a standard, and arrangements were made to have a number of the units built to strict specifications and installed on government vehicles. The designing and construction of an efficient filter for cleaning the gas, using local materials, demanded a considerable amount of experimental work. The preliminary work done in the Fuel Research Institute on the characteristics of charcoals made from various South African woods formed the basis of burning experiments by the Forestry Department. The Institute subsequently took over the designing and erection of kilns capable of producing an even grade of commercial charcoal.

Discussing the outlook for a new factory near Cape Town, a paint manufacturer said that the quality of production was insured by agreements with oversea manufacturers about the exchange of technical information. He had made arrangements with a Norwegian firm about marine paints, with a British firm about traffic paints, and with an American firm about plastic, or rubber-base paints. During the war South African paint manufacturers had to choose between satisfying a large demand for paints with second-rate materials, or selling a small quantity of first-grade products.

The allotment of metals required for paint-making under the existing controls left much to be desired. Oversea manufacturers could buy the metals at much lower prices than South African industrialists, yet he claimed that often the imported paints were inferior to those made locally. Few South African builders were aware of the progress made in painting materials. Both in England and South Africa the use of red lead primers was still predominant.

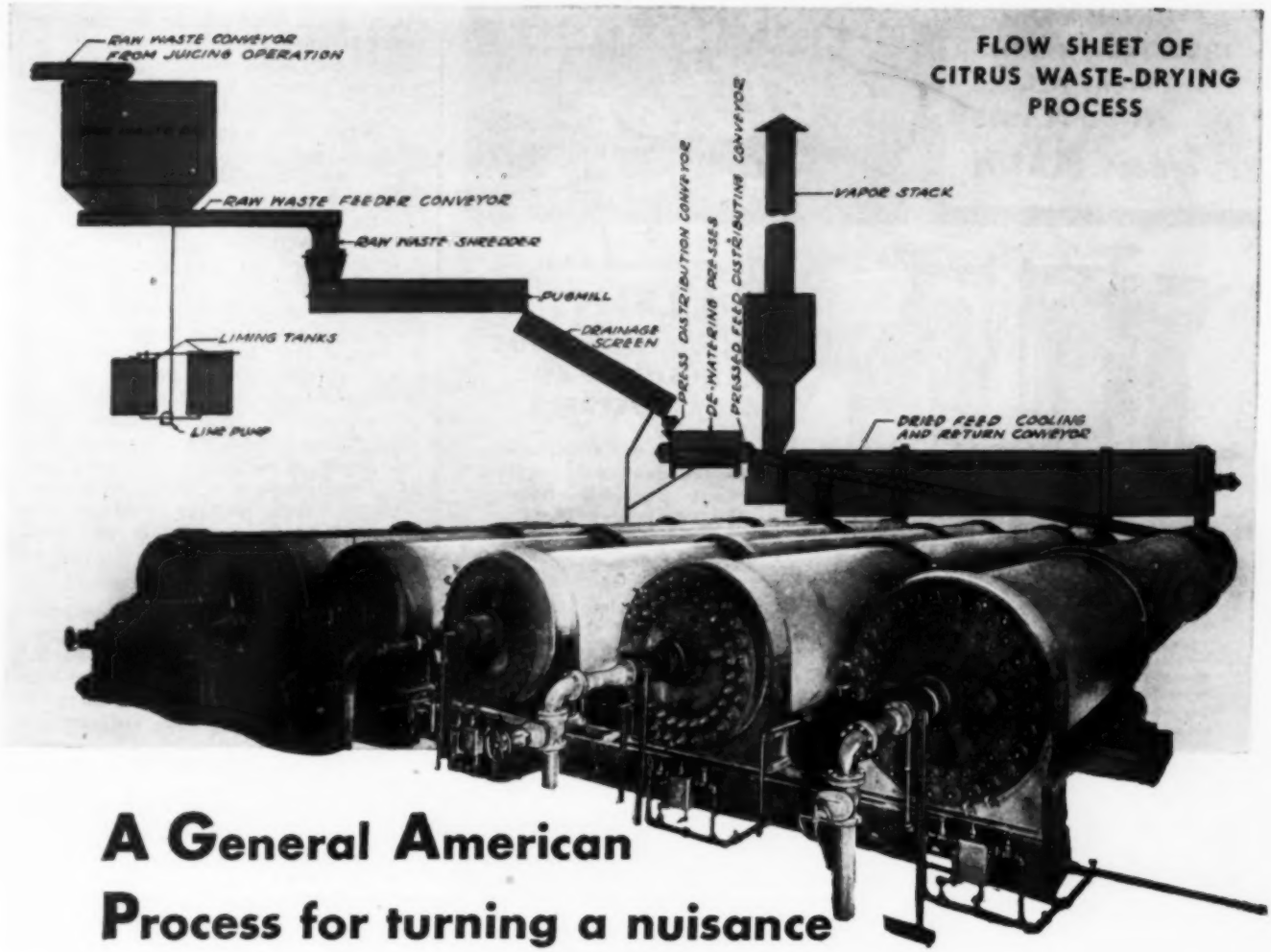
### NEW PLANTS FOR OILS

Industrial developments estimated to cost ultimately nearly $12 million are being considered by Lever Bros. (South Africa), Ltd. Plans involving an expenditure of about $4,000,000 have been completed for the company's Durban undertaking and more than $400,000 for the one in Cape Town. It is intended later to built a new factory in Johannesburg. The expansion of the company's existing site at Durban will involve the development of the edible oils and fats division of the factory as well as the soap division. The present South African staff of the company numbers about 2,400 persons, but later very much larger staffs will be necessary.

A Johannesburg firm is planning to cultivate beds of seaweed and exploit the crops for fertilizer and other useful products. The seaweed which is washed up on the beaches is said to be unsuitable for such purposes, and thus it is planned to establish and cultivate special beds. If the purpose was only the making of fertilizers, ordinary kelp would be good enough, but the main idea is to grow agar-agar. A Cape Town chemical concern has shown that the collection and processing of agar-agar can be made profitable in South Africa. Its supplies were found in the beginning mostly in the Langebaan area, about 45 miles from Cape Town.

A vital principle is said to be involved in the manufacture of DDT by the South African government. The plans cost more than £1,000,000. It was to produce DDT and other chemicals. Caustic soda and chlorine and various byproducts were involved. This was a departure from the proclaimed policy of maintaining private enterprise. The chemical industry believed in this field it could produce at lower costs than the government could do. A government official said the plant was established for special reasons and would be used for research as well as for commercial purposes.

During the war there was a serious shortage of shaving cream and toothpaste in South Africa, but now a number of famous oversea brands are again appearing on the market. Some of the substitute lines de-




# A General American Process for turning a nuisance into substantial PROFITS!

In the Florida citrus-fruit canning industry, Louisville Rotary Dryers made by General American led the way in eliminating the nuisance of canning wastes.

By converting citrus wastes into feed for dairy and beef cattle, losses due to the cost of waste disposal were turned into gratifying profits over and above the cost of waste processing. The General American organization is well equipped through its manufacturing facilities, its research and engineering staff and its experienced personnel to design, specify and build equipment needed in any waste-conversion process.

*Write for Bulletin No. 65.*

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GATX GENERAL AMERICAN

veloped in the Union during the war have vanished, replaced in some cases by the excellent locally made product with which in future the imported line will have to compete. There are branches of both American and British firms producing such needs in South Africa.

Some of the South African toothpastes contained as ingredients certain waste products from the Witwatersrand gold mines. As they seemed to have rather a gritty effect in use it was rumored that they were dangerous to health, apparently a groundless belief. But it was admitted that South African toothpastes were then not of the same standard as those formerly imported. Some brands introduced during the war are not well known, seeming to indicate that they enjoyed sales in limited localities only. South African factories are now making denture powder in addition to toothpaste, and hair fixing cream, using South African ingredients. Some of these firms are also manufacturing sanitary towels and pack epsom salts and such sundries.

### PRODUCTION OF PERFUMES

Perfumes of various types have been made in South Africa for many years, but during the war some export markets were lost and others in Africa gained. At the same time the manufacturers devoted more energy to developing the local market. They are now expecting keen competition from famous oversea brands. The best South African perfumes are marketed only after maturing for about three years, and the makers claim they can then warrant a bouquet equal to that of any imported perfume. They can offer only limited supplies of these qualities at prices that are rather high. It has yet to be shown whether the South African perfumes can hold this market in the face of the competition they are now likely to meet.

Valuable information has been gained in a preliminary experiment to determine the possibilities of controlling the tsetse fly by spraying DDT from the air, and it is said that the ideal of eradicating the fly does not seem to be impracticable. Of the effect on other insects, all that can be said at present is that some species are evidently more susceptible to DDT poisoning than others, and grasshoppers, crickets and other members of the same family were apparently unaffected, while flies generally seemed to be very susceptible.

In an address in Johannesburg it was claimed that South Africa was the richest country so far as deposits of chrome ore and platinum were concerned. South Africa's total production of chrome ore, from the time that records were first kept, to the end of 1944 was 3,385,632 tons, of which 3,382,248 tons were mined in the Transvaal and 3,384 tons in Natal.

The output for 1944 amounted to 60,628 tons and this was valued at £122,103, a substantial drop on the 1943 figures of 108,973 tons worth £246,373. Both figures are considerably lower than the 1938 output of 194,626 tons. South Africa's chrome deposits are situated chiefly in the Lydenburg and Rustenburg districts. The geological character is unusual in that the ore occurs in large tabular seams instead of in the usual and more erratic lenticular bodies.

While the deposits are believed to be inexhaustible, their high iron content places

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them at a disadvantage in comparison with Rhodesian ores. Chromic oxide contents as high as 50 percent have been found in samples of Transvaal Bushveld ore with a negligible amount of gangue minerals. The average content is much lower, however, owing to the presence of gangue minerals and variations in the composition of the mineral itself. This type of Transvaal ore is known as chromitite. It is typically black in color, sometimes with a yellowish-green tinge. It has a sub-metallic luster and its specific gravity ranges from 3.8 to 4.5. For industrial purposes the chromitite is characterized as friable and hard, lumpy, the latter variety being used mainly as a refractory material.

The important part that phosphatic fertilizers play in the agricultural development of South Africa has long been realized, and there has been much activity in searching for and in attempts to develop local resources during the past four decades. Apart, however, from guano sold by the government, supplies of such fertilizers up to the war were all manufactured in the country from imported materials. Large imports of phosphates are still being made from North Africa, but during the war the phosphate deposits in the Saldanha Bay area were developed and are now being marketed as fertilizers.

The Hoedjes Bay peninsula at Saldanha Bay is formed of granite and quartz porphyry concealed largely by sand and by soft white limestones of geologically recent origin. Around the shores are remnants of a shell-raised beach rising to some 30 ft. above the present sea level. The action of liquids from former superincumbent guano deposits has produced phosphatization of several types of rock in the peninsula and the resultant products cover a considerable area. The phosphate deposits are of two kinds: phosphorite and a type of hard brown heterogeneous phosphate rock, which is by far the more extensive, derived from the phosphatization of granite or quartz porphyry and carrying fragments of quartz, of altered feldspar or of the parent rock. The probable reserves of this rock run into hundreds of thousands of tons.

### SOVIET RESEARCH ON WOOD DISTILLATION CHEMICALS

PLANTS of the wood distillation branch of the Soviet chemical industry are engaged in extensive theoretical and applied research in a plan to derive additional chemical products from wood. Wood tar residue, left after distillation in the production of charcoal, has become a basic ingredient for manufacturing valuable chemical products. Tar oil, a wood tar product, has been found to be an excellent inhibitor for stabilizing benzine obtained by the cracking process, superior to the synthetic inhibitor employed for this purpose in other countries and less expensive and simpler to manufacture.

Another promising product of wood tar research is pitch. Proposed by chemists as a binder for foundry molds, it has replaced the more expensive starch and molasses at many foundries. Investigators pushed research further and found that additional processing yielded a new product, called berizol, suitable for cementing parts in motors.

Other products recently developed in-

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## STAINLESS-CLAD STEEL

cludes the black fur dye, pyrocatekhin, acknowledged as the best yet by furriers, production of which is to be launched on an industrial scale in the near future. Another novelty is sylvan, a byproduct in the manufacture of acetic acid, which is finding extensive application in the pharmaceutical industry in the production of various medicines, such as acrichine.

An important development of the wood chemical industry is wooden bearings. Produced from wood subjected to special impregnation, heat treatment and pressing, these bearings are very durable and last considerably longer than bronze ones. They have also proved superior to metal ones in underwater work.

The wood chemical industry has big prospects for further development, according to the industry's Central Administration. There are many plants employing wood fuel that can be equipped for processing the combustion waste products. The same is true in charcoal production. The Soviet goal is to turn all installations operating on wood fuel into a source of chemical products.

Dry distillation of wood as well as the manufacture of rosin and turpentine is slated for a big expansion in the next five years. New factories for the production of rosin are to be built which will process pine stumps.

### UKRAINIAN POTASH DEPOSITS UNDER DEVELOPMENT

TRAINLOADS of mineral fertilizers are now leaving the potash salt workings at Stebniki, a small Ukrainian village in the foothills of the Carpathians. More plant food for sugar beet and other crops will flow from Stebniki as large-scale development of the big deposits starts.

A detailed study of the deposits of potash was made last year by a party of geologists. According to Alexander Unkovsky, one of the participants in the expedition, the salt formation covers quite an extensive area. The thickness of the upper layer runs from 280 to over 400 meters. By sinking boreholes into the upper layer of the deposit geologists have established the presence of some 19,000,000 tons of workable mineral. The total amount of potash salts has not been established as yet. The area contains even greater reserves of ordinary salt. The mineral deposits contain from 15 to 29 per cent of potash as well as other chemicals.

One factor facilitating the development of the Stebniki finds is the proximity of large deposits of natural gas. Future plans include the sinking of another mine, expanding the capacity of the existing chemical fertilizer plant and the building of a soda factory.

### NEW USES FOR CASHEW SHELL OIL DEVELOPED IN INDIA

MOLDING powders with a better flow can be made by incorporating cashew shell oil in the lac-molding composition, the Indian Lac-Research Institute reported in a review of its studies during 1945. It was found that the cashew shell oil, partially polymerized by heating at 300 deg. C. for 15 to 20 minutes, and combined in quantities up to 25 to 30 per cent of the weight of lac, yielded molding powders with better

flow and augmented the plasticity of the composition.

It also was discovered that the lac-fatty acid varnish suitable for making oilcloth and other flexible waterproof fabrics, has better ageing properties, if made with castor oil fatty acid instead of linseed oil fatty acid. Samples coated with this new varnish were found to have retained their surface gloss and suppleness for well over a year. Cashew shell oil is not only a useful component of shellac molding powders, but also a valuable ingredient of several varnishes. With the admixture of this oil the varnish has become good for waterproofing paper and cloth and for giving acid- and alkali-resistant coating on metals.

The Research Institute reported that molding powders could be greatly improved if the present method of making them is slightly altered. According to the recommended new process, the lac-formaldehyde-urea resin solution is separately made and then mixed in a kneader with filler, pigments, and lubricants, the whole mass being rolled and powdered immediately after mixing. Further, by using as filler, sawdust which has been defibered by autoclaving or alkali digestion, the shock resistance of the molded article is increased by 30 to 40 percent. The Institute said the additional cost of such special treatment of sawdust can be avoided by combing the alkali digestion of sawdust and the recovery of lac from kiri into one single operation.

### POTASH PRODUCTION GAINS HEADWAY IN FRANCE

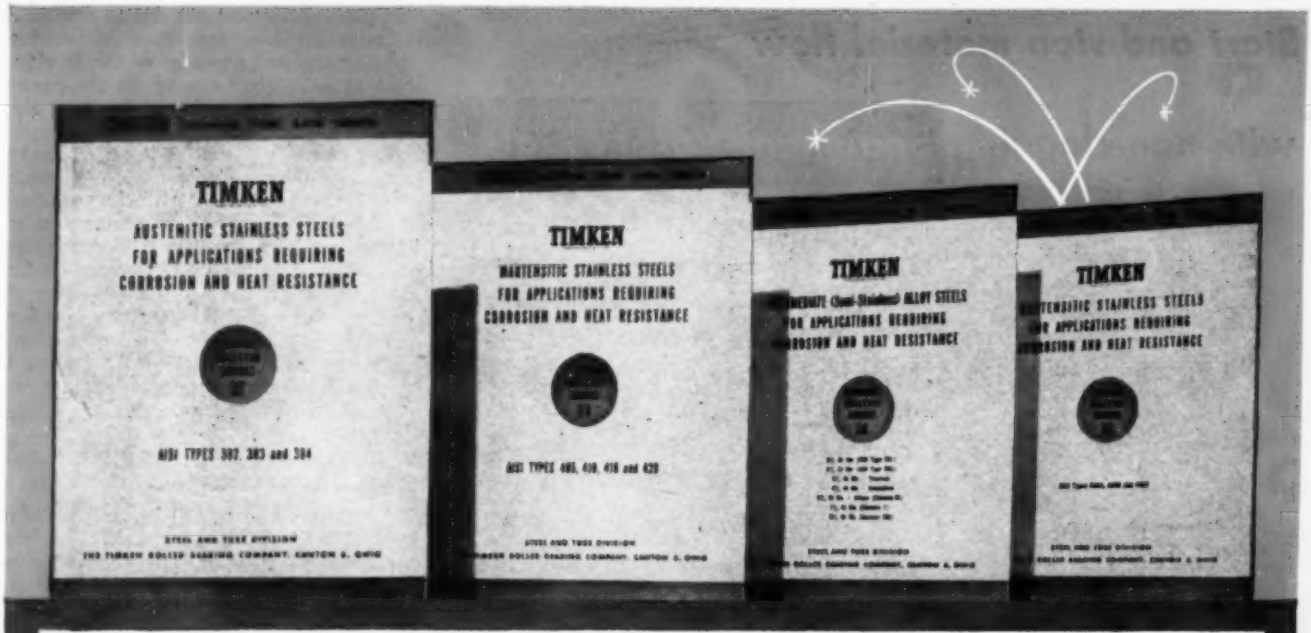
ACCORDING to unofficial reports, production of potash at Alsatian mines has been increasing steadily. The output for last July was given as 46,000 metric tons which advanced to 90,000 metric tons in August and to 115,000 metric tons in September. The supply schedule for 1945-46 was set at 440,000 metric tons of potash, which would be obtained from a new production of 350,000 tons and a withdrawal from stocks of 90,000 tons. France and the colonies are to receive the greater part of this supply but an exportable surplus of 160,000 tons is visualized.

### CANADIAN PLANT TO PRODUCE NITRATE OF AMMONIA

PRODUCTION of ammonium nitrate was established during the war period in the plant of Alberta Nitrogen Products, Ltd., at Calgary, Canada. There has been some doubt regarding the continuance of nitrate production at this plant in view of the fact that ammonia no longer is required for the manufacture of munitions. The Dominion Ministry of Agriculture has announced that the plant will continue such manufacture for at least the next two or more years in order to relieve the demand for the ammonia product in the fertilizer industry.

### ELECTROCHEMICAL PRODUCTION SURVEYED IN CHINA

OPPORTUNITY for developing certain electrochemical industries on a large scale rates considerable attention in current planning for the proposed Yangtze Valley hydroelectric development. Production of nitrogen fertilizers such as ammonium sulphate

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is of particular importance due to dire need for more intensive agriculture in the five densely populated provinces of the development area. Sulphur abounds in the region but cheap electricity is needed to extract the nitrogen from the air.

Vast reserves of the crude salt requisite for soda production likewise would come into industrial utilization with the operation of China's TVA, of which a huge dam at Ichang would be the pivot. China now depends almost entirely on foreign outlets for soda. Latest Chinese government survey of resources awaiting development in the five provinces reveal that abundance of sulphur, limestone, salt and nitrate make Hunan a logical site for eventual development of electrochemical industries.

### MEXICO TO HAVE NEW PIPE LINE AND REFINERY

A NEW oil refinery will be built at Salamanca, State of Guanajuato, by Petroleos Mexicanos (Pemex) and the company also will construct a pipeline from Poza Rica, Veracruz, to Salamanca, the total cost of the projects being reported at more than $7,000,000. The refinery will be a light oil plant and will have a capacity of 30,000 bbl. daily of enriched crude from the upper Veracruz and lower Tamaulipas oil fields. Production will consist of standard gasoline (about 65 octane), kerosene, diesel fuel, gas oil, fuel oil, and liquefied bottled gas. No lubricating oil will be made. It is possible that 70 to 80 octane gasoline will be made in the near future but it is not expected that a 100-octane unit will be built for several years because a unit of this type is under construction at Atzcapotzalco, near Mexico City.

### CHILE EXPANDS OUTPUT OF NITRATE OF SODA

RECENT announcement of production data reveals that Chile operated its nitrate of soda mines in the final quarter last year at the highest rate reached in at least the last three years. Production for the quarter was reported at 338,400 metric tons compared with 237,700 metric tons for the like period of 1944 and 273,000 metric tons for the final quarter of 1943. One new independent mine went into operation in the quarter and had a monthly output of about 1,800 tons. The rate of nitrate production in the immediate future is dependent largely on shipping facilities. Demand for the product is good and capacity production of 1,800,000 tons may be reached if shipping is available for moving the nitrate to consuming centers.

### CHINA WILL HAVE AMERICAN AS CHEMICAL CONSULTANT

THE National Resources Commission of the Chinese government has engaged the services of Ralph S. Lamie as chemical consultant. Mr. Lamie who is assistant to the export manager of the H. K. Ferguson Co. in Cleveland will retain his connection with the Ferguson company but will go to Formosa to assist in China's reconstruction of its industrial facilities. He holds a degree in chemical engineering from Michigan State College and is a registered professional engineer. Recently he supervised operations and served as general superintendent at the Fercleve Corp.'s thermal dif-


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WeldELLS provide an outstanding example of this specialized skill and knowledge. Consider such features as the selective reinforcement that provides uniform strength, the tangents which keep the weld away from the most highly stressed zone, the accurately sized ends and extreme accuracy of all other dimensions. Consider, in fact, all of the features listed opposite and we believe you will agree that

## WeldELLS alone combine these features:

- **Seamless**—greater strength and uniformity.
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- **Wall thickness never less than specification minimum**—assures full strength and long life.
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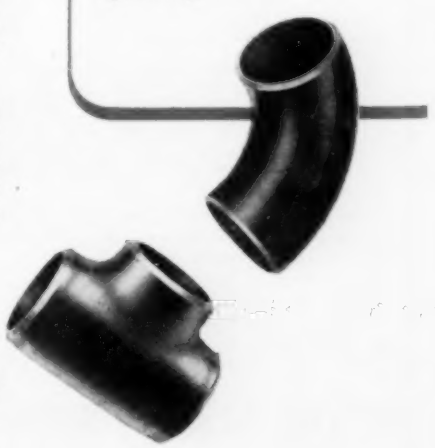

# WeldELLS have everything

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fusion plant which the Ferguson company built and operated at Oak Ridge, Tenn. Before joining Ferguson, he was superintendent of chlorine and caustic plants for Basic Magnesium, Inc., in Nevada.

### INDIA HAS MICA SUPPLIES OF INDUSTRIAL VALUE

A RECENT study of a large number of mica samples from the mines in Bihar, Madras, and Rajputana—made by the laboratory of the Council of Scientific and Industrial Research of India—revealed that the majority of samples possess a high dielectric constant and low power factor, which make the mica particularly suitable as insulating material in the electrical industry.

The study showed that the widely held view that green mica is inferior to ruby as an insulator is a myth, and both types of mica appear to be equally useful. Further research is planned to assess the value of mica for the manufacture of precision standard condensers and for high voltage work, where mica with special characteristics is required.

### ANNUAL FAIR AT BORDEAUX WILL BE RESUMED

REPORTS from France state that after a lapse of five years the Bordeaux Fair committee has announced that preparations are being made for holding the annual trade fair. It will open on June 23 and will run for two weeks. Participation by foreign exhibitors is desired by the sponsors. It is pointed out that a good many advantages on the part of the Administration of the French Customs are offered to participants from outside countries, about which details may be obtained from the U. S. Department of Commerce or any of its field offices.

### AUSTRALIA DEVELOPS DOMESTIC PRODUCTION OF TALC

DUE TO the interference with foreign trade which has been prevalent in recent years, Australia started to develop a supply of talc from deposits in that country. For some time requirements have been filled by the home product. With the return of more normal shipping conditions, the possibility of foreign competition has been weighed and the services of the Adelaide School of Mines have been enlisted to study processes for the removal of impurities from the talc and to develop a uniform product so as to retain as much as possible of the home market.

### BRITISH GOVERNMENT AIDS CHINA CLAY INDUSTRY

PRODUCTION of china clay in England has been adversely affected during the war period because of the transfer of workers to the armed forces and to other more essential lines of production. In the latter part of last year the British Government interested itself in returning workers to the clay pits. In addition to home demand it is reported that the United States had placed orders for clay to the amount of approximately $1,000,000. Production in the latter part of 1945 had been stepped up to a rate of about 98,000 tons a year compared with a rate of 62,000 tons maintained in 1944.

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# GERMAN CHEMICAL INDUSTRIES

## MELAMINE

MELAMINE was produced from dicyandiamide by the following process: 4,200 lb. of dicyandiamide were slurried with 3,600 lb. of isobutanol filtrate recycled from previous batches, homogenized in a wet grinding mill and pumped with a piston type pump over a 4.5-hr. cycle into a 1,000 gal. autoclave which had been previously charged with 176 lb. of liquid ammonia and heated to 180-185 deg. C. The reaction was maintained at 180-190 deg. C. during the pumping period by using either high pressure steam heat or cooling water at various phases of the cycle. The operating pressure was 30-40 atm. As soon as all the dicyandiamide had been added, the reactor was held at 185 deg. C. for 2 hr. The mass was then cooled to 25-30 deg. C, blown to a pressure filter and the melamine residue dried by distillation of the solvent. The filtrate and the distillate were combined and used to slurry the next batch of dicyandiamide. The crude dry melamine was extracted with a dilute NaOH solution, filtered and washed. Yield was 4,620 lb. of a paste containing about 3,630 lb. of dry melamine or about an 87 percent yield.

MAPRENAL MJB was a condensation product of melamine and formaldehyde in butanol. The product was sold for lacquers.

The charge to the 1,000-gal. jacketed steel reaction kettle was:

| | |
|---|---|
| Formaldehyde—37%—neutralized to pH 8 with soda | 3,200 lb. |
| Melamine | 805 lb. |
| Isobutanol | 2,560 lb. |
| Magnesium carbonate | 5 lb. |
| Benzene | 320 lb. |

The mixture was heated and distilled until about 1,160 lb. of water had been distilled and separated from the azotrope overhead. 12 lb. of phthalic anhydride was then added and the distillation continued until evolution of water ceased. The mixture was then cut with 730 lb. of butanol, or isobutanol and filtered.

Yield was 4,850 lb. of product containing 51-53 percent dry solids.

BENZOGUANAMINE formed the basis of a new melamine type lacquer material which had recently been put into production and showed considerable promise because the resulting lacquer showed a good gloss and a better heat stability than the regular melamine type product. The intermediate, known as benzamin (4, 6-diamino-2-phenyl-1, 3, 5 triazin) was made by the following process.

The reactor, fitted with a bottom discharge, and equipped for oil heating was charged with:

| | |
|---|---|
| Benzonitrile | 363 lb. |
| Potassium carbonate | 30 lb. |
| Piperidine-catalyst | 11 lb. |

and the mixture heated to 180-185 deg. C. During the course of 2½ hr. there was added to this charge a preheated slurry (90-100 deg. C.) containing:

| | |
|---|---|
| Dicyandiamide | 750 lb. |
| Benzonitrile | 1,450 lb. |
| Piperidine | 44 lb. |

Following the addition of the dicyandiamide slurry, the mixture was heated for 2 hr. at 185-190 deg. C. Then the benzonitrile-piperidine mixture was distilled off under reduced pressure and the dry crude benzamin withdrawn through the bottom outlet. The product was ground and extracted with hot water on a suction filter. Yield was 2,200 lb. of paste containing 1,520 lb. of dry product.

Digest from "I.G. Farbenindustrie A.G., Mainkur Works, Fechenheim" OPB Report No. 203 by R. W. Sudhoff.

## METALLIC SODIUM

FIVE and a half tons per day of sodium metal were produced by I. G. Farben at Gersthofen in 120 cells operating at 5,000 amp. and 4 v. per cell, requiring 5 d.c. kwh. per lb. The cells are 36 in. in diameter and 39 in. deep and contain a copper ring ½ in. thick with 18 in. outside diameter placed central which serves as cathode. Concentric is a nickel anode 22 in. i.d. about the same (½ in. thickness) and the same length which is connected to the pot for electrical current. The electrodes are covered with about 35 in. of bath which consists of 84 percent NaOH, 12 percent NaCl, and 4 percent $Na_2CO_3$. The NaOH feed must be dry. The bath fouled in two months and must be renewed. Primary freezing of NaOH occurs at 320 deg. C. which was the operating temperature of the cell. The cathode is supported by its terminal which goes through the bottom and is sealed in the bottom by frozen NaOH. Between the electrodes a 19 in. diam. steel gauze is suspended which serves as a diaphragm. It is suspended by a solid steel collar, reduced to 8 in. diameter in which sodium collects. The metal is dipped every 20 min. The production of 11,000 lb. per day requires 384 man hours, and the cost is estimated at 37 pf. per lb.

Digest from "The Electrochemical Industry, Burghausen Area" O.P.B. Report No. 354 by R. M. Hunter.

## IMPROVED COKE-OVEN GAS

IT IS well known that the quality of the gas made in the coke oven changes over the period of heating. The gas evolved during the first few hours is richer in unsaturated hydrocarbons and aliphatics than during the later period, due to the fact that the distillation gases from the center of the charge must pass through a layer of red-hot coke and over hot brickwork on their way out to the hydraulic main and a considerable degree of cracking of the hydrocarbons occurs.

To overcome this, a method was devised to operate the ovens with a central withdrawal pipe for the gas. This principle has been adopted at Volklingen.

When the oven is charged with coal, a series of holes are drilled through the charging holes vertically, along the middle axis, to within about 18 in. of the oven sole. Into each of these holes a pipe is inserted penetrating about 18 in. below the surface of the coal. These pipes are subject to a suction of 300 m.m. w.g. The time of heating the oven charge is 18 hr.

Gas for the first 4 hr. of heating which is withdrawn in the normal manner from


# COOPER'S 25 YEARS

## . . . and what they mean to users of Stainless Steel Castings

The quarter century spent by Cooper in specialized study of stainless steel castings is strongly reflected in the company's ability to produce sound castings—and to give equally sound advice on their application. Over such a long period, it was inevitable that this ability of Cooper's to produce a superior product would become known to industry everywhere—with the natural result that Cooper's business growth has been phenomenal.

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the upper part of the oven, is mixed in one hydraulic main and cooling system with the gas which is withdrawn during the first 10 to 12 hr. from the central pipes. This is termed *E* Gas.

Gas from the upper part of the oven for hours 5 to 18, and that from the central pipes, hours 13 to 18, are collected separately and termed *A* gas. This *A* gas is cooled and treated in the normal manner for recovery of byproducts and has 4,250 cal. per cu. m.

The *E* gas is rich in the higher hydrocarbons, and high in sulphuretted hydrogen and is treated in a separate system. The gas is cooled for removal of tar. This tar is rich in phenols, oils (15 percent aliphatics) and contains about 30 percent pitch. The gas is washed with water to remove $NH_3$ and $H_2S$; desulphurized with iron oxide; compressed to 9 atm. and washed with special wash oil (b.pt. 70—200 deg. C.) to remove propane, butane and light benzines; washed with normal wash oil to remove benzol. The gas is reserved for use in the O. H. steel furnace and has 4,800 to 5,000 cal. per cu. m. It was used cold, mixed with tar of road quality (60 65 percent pitch, 30 percent oil) in steel furnaces and gives excellent hot-working conditions.

Digest from "Rochling'sche Eisen und Stahlwerke G.m.b.H." OPB Report No. 847 by T. P. Colclough.

## SODIUM CYANIDE

The cyanide part of the I. G. Plant at Ludwigshafen was partly destroyed by bombing, but a considerable portion of the equipment was intact. The plant consists of equipment for the manufacture of sodium cyanide by three modifications of the formamide process. Formamide is produced by the action of carbon monoxide on methanol in the presence of ammonia, as follows:

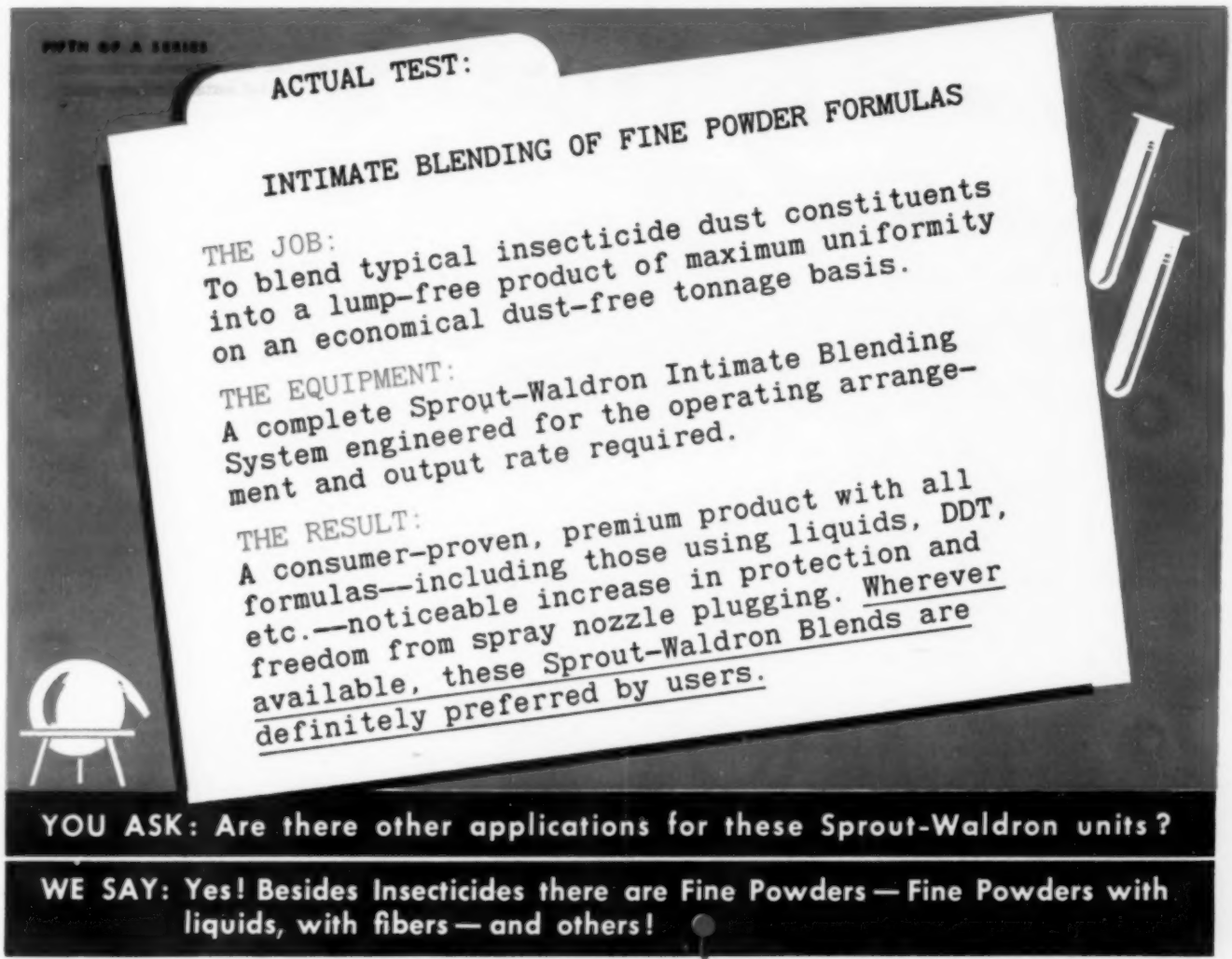
$$CH_3OH + CO \rightarrow CHO.O.CH_3$$
$$CHO.O.CH_3 \rightarrow CHO.NH_2 + CH_3OH$$

In the presence of ammonia, and under definite conditions of temperature, etc., formamide splits up into hydrocyanic acid and water:

$$CHO.NH_2 \rightarrow HCN + H_2O$$

In general terms the sequence of operations is as follows: Volatilized formamide 3 percent with ammonia 97 percent is passed first through a filter filled with Raschig rings, then over a catalyst consisting of aluminum phosphate on Bolus Alba and under a temperature of 350-370 deg. C. The gas which then contains HCN, water and ammonia, passes through a cooler from which some condensate is removed, then through an absorber filled with Raschig rings, and fed with 50 percent caustic soda solution. This absorbs excess moisture and HCN, thus drying the gaseous ammonia which is recirculated. The resulting solution, containing some 30 percent NaCN then passes to the first evaporator, where the major portion of the ammonia is removed, then to vacuum evaporators, in the first of which the remaining ammonia is evaporated. The solution is finally evaporated to dryness yielding a powder-like sodium cyanide of not less than 90 percent which is briquetted.

In view of the very weak concentration of HCN in the gaseous mixture obtained by

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**Explain powder-liquid blending, you say? Liquids are *readily* incorporated so long as a free-flowing product results. Sprout-Waldron's Development Laboratory can *easily* handle such problems.**

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*solve your mechanical preparation problems!*

this process it is not possible to obtain gaseous HCN as a final product and this necessitates the absorption in caustic soda.

In a third plant installed at Ludwigshafen, but only on a pilot scale, the process adopted is different. In this process ammonia is not used. Instead, volatilized formamide is passed rapidly through a battery of iron tubes heated to a temperature of 370-400 deg. C. and kept under vacuum of absolute pressure 4 mm. Hg. The tubes are provided for some part of their length with iron cores, so that an annular space is provided for the passage of the gas, thereby promoting good contact with the heated iron, which acts as a catalyst. The reaction is stated to be slightly endothermic (— 25 kg. cal. per kg.) and according to reports conversion to HCN and water is practically complete.

The conversion efficiency of formamide to NaCN of 90 percent grade is claimed to be 83 percent, with approximately 2 percent loss of ammonia. The efficiency of the pilot plant should be greater, inasmuch as HCN is produced in the gaseous state without the use of ammonia.

Digest from "German Carbide, Cyanamide and Cyanide Industry" OPB Report 516 by W. G. McBurney, G. W. Sinclair and H. S. Sutherland.

### GLYCERINE BY HYDROGENATION

ANOTHER extremely interesting chemical product developed at Hochst is for the production of glycerine from cheap sugars by hydrogenation. A plant capable of producing over 1,500 tons in 1944 was inspected and the process reviewed. Sugar is dissolved in water, inverted with ½ to 1 percent oxalic acid and then subjected to hydrogenation at 200 deg. C and 399 atm. pressure through a series of tubular reactors. Nickel on pumice is the catalyst used. The reactant mass is filtered, cleared with charcoal, and dried under vacuum. It consists of the following mixture: Glycerine, 40 percent; propylene glycol, 40 percent; and hexahydric alcohol, 20 percent.

This mixture was being used as recovered, and was not being fractionated for nitration purposes. It was stated that the material was used as a substitute for glycerine where the physical properties of the mixture were suitable. There may be reason to doubt the veracity of these statements because such a mixture could be fractionated readily if so desired.

Digest from "I.G. Farbenindustrie A.G. Plant, Hoechst/Main" OPB Report No. 183 by P. J. Leaper.

### PRODUCTION OF HYDROGEN PEROXIDE

IN GERMANY the use of hydrogen peroxide for military purposes had expanded tremendously in the last year. It was used for: assisted take-off units, both with a hydrazine hydrate fuel and by direct decomposition with permanganate; torpedoes, with hydrazine hydrate decomposition and fuel; U-boats, with solid catalyst in conjunction with fuel oil; rockets, launching V-1, and auxiliary pumping V-2, with permanganate decomposition.

The Electro Chemische Werke München A. G. was one of the largest producers of concentrated hydrogen peroxide in Germany. Production was carried out in two steps. The first, for the production of 35 percent solutions, was by the Adolf-Pietzsch Process

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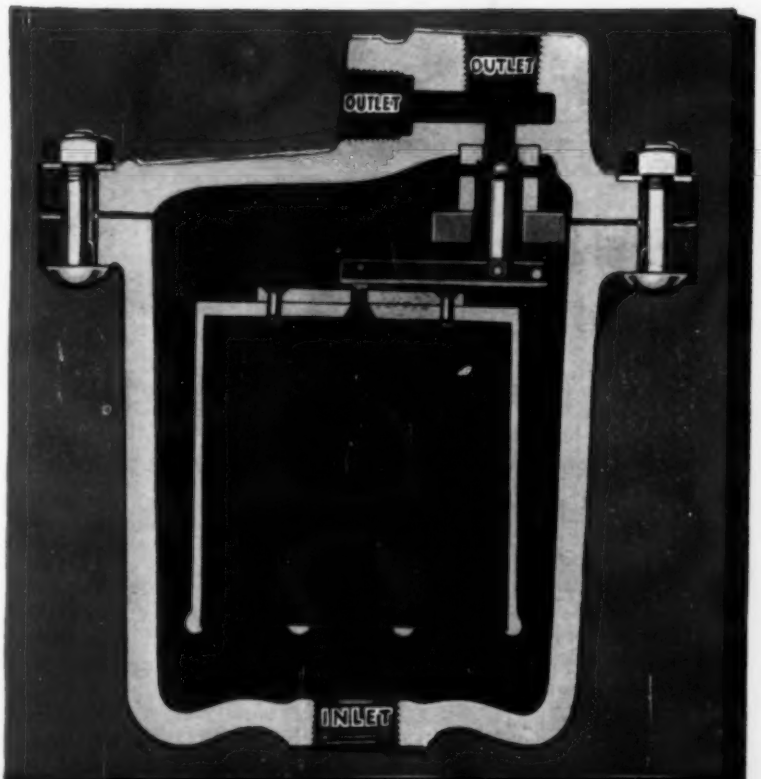


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which is well known in the United States, and is in use by the Buffalo Electro Chemical Co. This step involves the electrolysis of a concentrated solution containing $KHSO_4$, $H_2SO_4$ and $(NH_4)_2SO_4$. Solid $K_2S_2O_8$ is subsequently separated and treated with 18N-$H_2SO_4$ and steam to give 35 percent $H_2O_2$. This is concentrated by distillation to 72 percent in the first stage and to over 80 percent in the second.

The step of most interest is the method of concentration of the 35 percent solutions to 80 percent or higher which makes possible the use of peroxide as an efficient fuel in submarines, rockets, rocket aircraft, assisted take off units for aircraft, and torpedoes.

Hydrogen peroxide in Germany is known as "T-Stoff." The name seems to have been derived from Thymiol, the old code name of $H_2O_2$. (Other names: Aurvl, Ingo'in and Neutralin, the latter referring to the 35 percent material.) Three grades were furnished: TN, (general use); TS (submarines); and TSS (torpedoes). The first was the most impure and was stabilized to about the same extent as the third. The second and third were very pure. The second was not strongly stabilized; it did not need to be since it was separated from sea water only by a polyvinyl chloride bag, which was carried just beneath the outer hull of the submarine. The third had to be highly stabilized because torpedo performance depended upon the strength of the peroxide.

The concentration plant at Höllriegelskreuth has a capacity of approximately 400 tons per month of 80 percent material. The original capacity of the primary production plant for 35 percent peroxide was about 180 tons per month calculated as 80 percent. This plant was bombed out in June 1944 but the concentration plant was left intact. Since then a new plant, capable of producing 50 tons per month of 35 percent peroxide calculated as 80 percent has been built but was never put into operation. The concentration plant is still in excellent condition, ready for immediate operation. It consists essentially of five ceramic columns; each fitted with a dephlegmator and condenser at the top, and a still and separator at the bottom. All five columns are the same; however, in operation, four act in parallel for concentrating to 72 percent and the fifth does the final concentration to 83 to 85 percent.

Raw 35 percent material is obtained from the primary production plant through temporary storage tanks. It is stabilized with 0.1 g. 8-oxyquinoline and 0.1-0.3 g. tetra sodium pyrophosphate per liter; and is 0.01 N acid. $AlPO_4$, $(NH_4)_2SO_4$, $KHSO_4$, $H_2SO_4$, $Na_4P_2O_7$ are present as impurities. Entering the four ceramic stills it is mass heated through V14A stainless steel heating coils. Supervision is very particular that these coils be made of V14A steel which is a hard, high molybdenum stainless. A mirror finish is required. The steam in the coils is at 3 to 4 atm. gage pressure and the pressure inside the still above the liquid is 45 mm. Hg. The temperature of the liquor is 65 deg. C.

After equilibrium is established, the liquid phase contains 75 percent peroxide and the vapor phase passing to the separator contains 35 percent peroxide. The liquor is now 0.05-0.10 N in acid.

Vapors enter the separator which is a

ceramic or aluminum vessel divided near the center by about 4 m. of Raschig rings. The vapors enter below this division, pass through the rings and exit from the top of the separator to the bottom of the rectifying column. The separator thus acts to remove entrained liquid and also as a very short distillation column. The bottom of the separator drains back into the still.

From the separator, the vapors pass to the bottom of the rectifying column. This is ceramic of 1,050 mm. diameter packed with 4 m. of 25 x 25-m. ceramic Raschig rings. The vapors pass up the column, are concentrated and the effluent gases are cooled by a double-walled water-cooled aluminum dephlegmator. From this, they flow to a water condenser. These vapors still contain some peroxide and approximately 0.5 percent of the total peroxide distilled is lost in the condenser cooling water. The concentrated 70 percent peroxide flows down the column to the final concentration still. No reflux water is added to the column.

The 70 percent peroxide enters the final concentration still; and, after equilibrium is established, the liquid phase peroxide concentration is 83 percent and the vapor phase 56 percent. The temperature in the liquid phase in the still is 70 deg. C., and the vapor phase pressure is 45 mm. Hg. The vapor enters the separator in the same manner as in the original distillation and from there enters the bottom of the rectifying column, travels up the column and is condensed. The higher concentration flows from the bottom of the column and re-enters the still. The finished product flows continuously from the still to coolers and to storage. By varying the conditions in this final concentration step slightly, different grades of peroxide can be produced. Also it is possible to draw from the bottom of the column directly thus making this step a distillation.

After about five days of operation, the impurities of the raw product build up in the original distillation stills until a solid content of about 80 g. per l. is reached. This approaches the dangerous concentration and flashes of light can be seen in the still. The still is shut down, drained, and flushed out. The residues are recovered.

The residues containing 72 percent peroxide flow to a Raschig ring packed distillation unit where they are heated by direct injection of steam and also by heating coils. The vapors leaving the top of this unit containing 9 percent peroxide pass through a separator and enter the bottom of a rectifying column. This column is similar in construction to the others used in the distillation apparatus. From the bottom of the rectifying column, 30 percent peroxide is obtained and is recycled to the raw product feed. The residue from the bottom of the distillation pot contains 10 percent peroxide and a very high concentration of salts. This concentration was over 50 percent solids and is discarded. The peroxide loss in this is 1 percent of the total peroxide distilled. The over-all efficiency of the process in the reconversion of 35 percent peroxide to 80 to 85 percent is 98 percent. This recovery is excellent.

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Digest from "The Manufacture of Hydrogen Peroxide" OPB Report No. 20 by H. A. Liebhafsky, and "Hydrogen Peroxide; Electro Chemische Werke, Hollriegelskeuth" OPB Report 215 by W. G. Gormley.

# CORROSION FORUM

EDMOND C. FETTER, Assistant Editor — MODERN MATERIALS • MODERN METALS

## CORROSION REPORTER

NOT QUITE two years ago the silicones were first being introduced as commercial products. At that time it was known that silicone greases and resins were remarkably resistant to the forces which are normally destructive of their organic counterparts, and it was inferred that they ought to find ready and valuable application as materials of chemical plant construction. Since then, modest quantities of the various silicones have been produced and field tested. On the basis of this experience, some examples of which are given below, it appears that the first optimism was not unjustified.

### SILICONE GREASES

A NUMBER of reports have been received on the successful use of silicone lubricants in difficult applications involving high temperature, acid or moisture. The virtual elimination of lubrication problems in high temperature kilns and paper machine dryers, to cite two random examples, has been indicated in trials made in operating plants. An indication of the product's value is gained from the fact that heretofore the Merco Nordstrom Valve Co. has never had a valve lubricant which it felt could be recommended for lubricated, quick-opening plug valves on steam connections. However, by taking advantage of the three combined properties, namely, heat resistance, water resistance, and retention of consistency at elevated temperatures, which are exhibited by silicone plug valve greases, that company is now able, for the first time, to recommend such valves for steam service when used with this lubricant.

Gaskets and pump packing materials have been coated with silicone greases to protect against temperature and chemicals. Leather gasmeter diaphragms were protected against the deteriorating action of natural gas by a coating of silicone grease and are still soft and pliable after a year and a half of service; untreated diaphragms in the same service hardened and cracked after one year.

A particularly tough valve problem in a cellulose products plant required that a number of lubricated plug valves handle reaction mixtures consisting of HCl gas, ether, ethyl chloride and water at temperatures around 570 deg. F. Operation of these valves was frequently accomplished only under the coercion of blow torch and long length of pipe. Since silicone greases are at once resistant to heat, acid and moisture, they were given a trial and operating difficulties disappeared.

In another application, a silicone grease has been used for approximately a year as a lubricant for plug cocks handling 50 percent caustic and 93 percent sulphuric acid. In this application the silicone showed marked superiority to greases formerly used.

### SILICONE COATINGS

Protective coatings based on silicone resins have been prepared as pigmented varnishes using aluminum powder and have been used successfully on many steel surfaces at temperatures up to 570 deg. F., including furnace fronts, stacks, and diesel engine mufflers. It has been found that mineral pigments, while they can be and are used, do not withstand as high temperatures as aluminum.

These so-called silicone paints can apparently be made with a high degree of resistance to almost any element likely to be destructive to such coatings, but they must, in their present state of development, be well baked at relatively high temperatures.

Largest proving ground for the coatings has been around hot equipment in a number of midwestern oil refineries. One such refinery reports the use of a silicone paint on oven trays used to dry a mineral containing small amounts of sulphuric acid at oven temperatures sometimes reaching 550 deg. F. Ordinary black iron trays rust badly and begin to scale in about ten days; after two months the silicone resin coating has worn somewhat and some rust is beginning to show through, but another coat seems to give complete protection.

### SILICONE MOTOR INSULATION

The advent of the silicones has made available for the first time a varnish which can keep pace with Fiberglas and mica in the insulation of motors. When glass-served magnet wire, mica-glass slot insulation, and glass tape, sleeving and tying cord were introduced not so many years ago, they represented a substantial improvement over all-organic insulation. But until now, bonding resins and varnishes have remained organic, and a weak link in the over-all insulation. Just how successful silicone varnishes have been in resisting the moisture, heat and chemicals which team up to break down organic varnishes is revealed in the following case histories reported by the electrical superintendent of the Dow Chemical Co.

"About 18 months ago our product development men asked us to try their new silicone impregnating varnishes. They obtained silicone-bonded Fiberglas-served magnet wire, silicone varnished Fiberglas tape, and silicone bonded mica-glass slot liners from several fabricators who were experimenting with the use of silicone varnish in the manufacture of silicone insulation. We wound several motors using these materials and impregnated them with silicone varnish. Most of these motors are still in operation and we have since rewound many more.

"The silicone impregnated Fiberglas magnet wire was smooth and gave the winders no trouble from unbonded glass fibers. We used mica-glass sheet insulation for the slot liners and the phase insulation. Coil separators were made by laminating several thicknesses of silicone-varnished glass cloth with silicone resin. Silicone varnished Fiberglas tape and sleeving were used and all tying was done with Fiberglas cord.

"The stators thus wound with silicone insulation were impregnated with silicone varnish, following the same procedures established for organic varnishes. We used our varnish baking oven for removing the solvent from the silicone impregnated machine.

"In our plant we have more than 6,000

## NEWS BRIEFS

EIGHT corrosion papers (listed in February issue, p. 225) will be presented on the morning of Thursday, April 11, as one session of the national meeting of The Electrochemical Society, Tutwiler Hotel, Birmingham, Ala., April 11-13.

NATIONAL Association of Corrosion Engineers will hold its 1946 annual convention in Kansas City, Mo., May 7-9.

THE REGULAR Gibson Island Conferences sponsored by the American Association for the Advancement of Science will be held this summer during the weeks of June 17 through August 23; conferences on corrosion will be held during the week of July 15-19 under the chairmanship of Dr. H. H. Uhlig. Applications to attend should be sent to Sumner B. Twiss, Wayne University, Detroit 1, Mich. This is the ninth summer that the Association has held special research conferences on chemistry and its allied fields. The program this year, as far as corrosion is concerned, is as follows:

**Monday, July 15—**
"The Electrolytic Theory of Oxidation and Tarnish," W. E. Campbell
"Fundamental Factors in the Oxidation of Metals and Alloys," J. B. Austin

**Tuesday, July 16—**
"Alloy Compositions for High Temperature Applications," Oscar E. Harder
"Stress Corrosion of Materials Exposed to Gasoline Combustion Products," S. D. Heron

**Wednesday, July 17—**
"Internal Oxidation," F. N. Rhines
"Alternate Oxidation and Carburization," Harry K. Ihrig

**Thursday, July 18—**
"Corrosion by Chlorine and Hydrogen Chloride at High Temperatures," Marshall H. Brown
"Hydrogen Attack on Metals at High Temperatures and Pressures," Aaron Wachter

**Friday, July 19—**
"Corrosion by High Temperature Steam," G. A. Hawkins
"Recent Trends in Alloys for High Temperature Service," W. O. Binder

three-phase motors in all kinds of services. Most of them are connected to non-shock, easy starting loads like pumps and fans. Many of them are overloaded and many must operate under difficult service conditions. Several overloaded motors which failed every few months were rewound with silicone insulation. For example, we have a 7½ hp. silicone insulated motor connected to a 10 hp. load in a continuously wet location pumping a slurry of magnesium sulphate. The motor is located in a pit beneath the evaporator and is frequently hosed off to remove encrusted salts; it is subjected to overloads when the slurry becomes heavy. This motor had a service life of from six to nine months. Rewound with silicone insulation, it is still in operation after two years.

"As another example, we rewound a 20 hp., 3,600 rpm. fan motor with silicone insulation. This motor is located on top of a heat treating oven and has a hard starting cycle along with high ambient temperature. It has been driving a 30 hp. load for about four months.

"Motors attached to centrifuges in the crystallizer rooms are frequently overloaded and are equipped with thermal overload protectors which save them from burning out. However, production is interrupted for about ten minutes every time a motor kicks out. After motors were rewound with silicone insulation higher amperage protectors could be installed.

"The motor driving one batch centrifuge had a service life of less than six months. Organic solvents and moisture, combined with heating caused by initial overloads, contributed to early failure. Rewound with silicone insulation, this motor is still in excellent condition after a year of service."

## LITERATURE REVIEW

**Study of Corrosion Pattern in Still Tubes Results in Reduction of Metal Losses.** W. F. Kraemer, *National Petroleum News*, Jan. 2, 1946, pp. R17-R22:—The Toledo refinery of the Pure Oil Co. has found that by plotting the annual measurements of the inside diameters of still tubes, patterns are obtained which indicate the corrosion trend and provide the basis for more efficient selection of metals for replacement tubes. Article describes procedure and findings.

**Silicon Iron (14-16 Percent Si).** J. E. Hurst and I. E. Baggs, *The Industrial Chemist*. Part I, Nov. 1945, pp. 606-612. Part II, Dec. 1945, pp. 649-654:—Part I covers trade names, composition, physical and mechanical properties, and four pages on corrosion resistance. Part II deals with methods of manufacture, fabrication, and metallography.

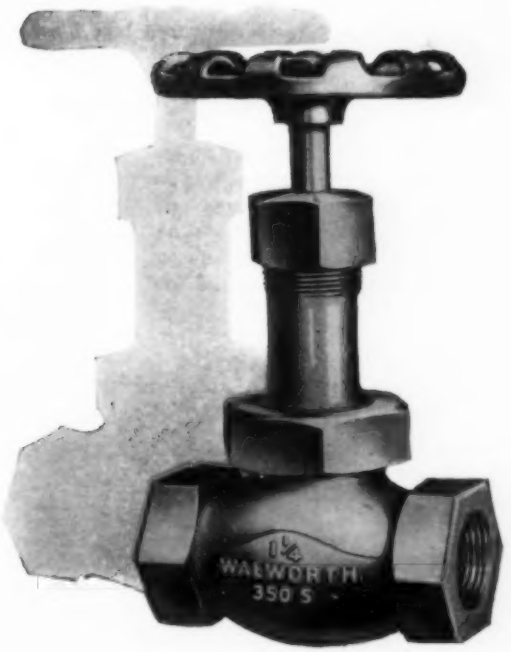
**The Gas Turbine.** *Inco* (International Nickel Co.), Winter Edition 1945-1946, pp. 4-7, 24, 25:—Gives considerable detail on the application of various metals and alloys in the construction of the Elliott Co.'s gas turbine engine.

**Stainless Steel—Many Types for Many Uses.** H. C. Esgar, *Southern Power and Industry*, Feb. 1946, pp. 52-55:—Summarizes properties and cites applications for the various types of stainless. Discusses welding and annealing methods.

**Vital Importance of Corrosion in Freight Equipment.** W. B. Brooks, *Corrosion and Material Protection*, Nov. 1945, pp. 21-24:—Some features of corrosion as it occurs in steel, hopper bottom railroad freight cars.

**The Canning Method for Preserving Ordnance.** *Corrosion and Material Protection*, Oct. 1945, pp. 7-9:—Outlines procedure by which army ordnance, from instruments to artillery, is sealed in steel or aluminum "cans" for permanent outdoor storage. As an example of costs and the like, the case of a ten-ton, 90-mm. anti-aircraft gun is cited as follows: Cost of canning, 5 percent of the cost of the gun; size of can, about 20x10x8 ft.; weight of can, one ton for aluminum or five tons for steel.

**Corrosion of Lead by Oxidizing Agents and Lauric Acid in Hydrocarbon Solvents.** C. F. Prutton, D. Turnbull, and D. R. Frey, *Ind.*

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*and Eng. Chem., Ind. Ed.*, Oct. 1945, pp. 917–924:—Reports a research project in the field of bearing metal corrosion by acid lubricating oils. Shows corrosion rate's dependence upon concentrations of acid and oxidizer.

**The Factor of Corrosion in the Cleaning and Processing of Metals.** S. G. Thornbury, *Corrosion and Material Protection*, Oct. 1945, pp. 15–16:—Cites some of the problems that had to be solved in developing and using cleaning solutions for aluminum, magnesium, and steel.

**Potential Curves for Iron in Hydrochloric Acid.** Robert D. Misch and H. J. McDonald. *Corrosion and Material Protection*, Oct. 1945, pp. 17–20:—Reports a research yielding potential vs. time curves as obtained under varied conditions of pH and aeration.

**Damage From the Coal Pile.** H. M. Spring, *Southern Power and Industry*, Oct. 1945, pp. 50–53, 67:—External corrosion of boilers by sulphur-base acids from coal and soot.

**Inhibitive Polar Type Rust Preventives—Synthesis and Use.** James E. Shields, *Corrosion and Material Protection*, Nov. 1945, pp. 6–10.

**High Pressure Corrision.** *Corrosion and Material Protection*, Nov. 1945, pp. 11, 12, 20:—Exerpts from notes left by the late D. P. Meigs. Contains new information on corrosion in equipment under high pressure.

**Stress Corrosion Cracking of Mild Steel, Part I.** James T. Waber and Hugh J. McDonald, *Corrosion and Material Protection*, Nov. 1945, pp. 13–18:—Corrosion cracking and precipitation hardening: association of the two phenomena. Bibliography of 101 entries.

**U. S. Navy Corrosion College.** *Corrosion and Material Protection*, Oct. 1945, pp. 10–14:—Gives background and present curriculum of the Navy's Matérial Preservation School at the Philadelphia Navy Yard, a school established to give instruction in the preservation of inactive ships. Army, Navy, and civilian personnel are taught the use of dehumidification, coating, and packaging techniques as applied to the preservation of hull, machinery, ordnance, and equipment of ships to be placed in inactive status.

**Corrosion of Aluminum by Die Materials.** P. A. Haythorne, *Iron Age*, Sept. 20, 1945, pp. 72–73:—Corrosion of Alclad 24S sheet metal parts formed on low-melting alloy dies. Cause, remedy, and insurance against recurrence.

**Corrosion Resistance of the Stainless Steels.** Carl A. Zapffe, *Metal Progress*, Oct. 1945, pp. 693–707:—Discussion of the general principles underlying stainless' ability to resist corrosion; rôles of the several alloying elements and the effect of the steel's metallurgical condition. Discussions of a few prominent applications and a seven-page retabulation (almost verbatim) of the data on stainless steel published in *Chem. & Met.'s* Eleventh Report on Materials of Construction, Oct. 1944.

**Corrosion Resistant Characteristics of Some Condenser Tube Alloys.** A. W. Tracy, *Corrosion*, Sept. 1945, pp. 103–112:—Types of corrosion occurring in the petroleum refinery; dezincification; impingement corrosion; stress corrosion; fatigue failures. Applications in the refinery for the several types of copper alloys.

**Light Metals for the Cathodic Protection of Steel Structures.** R. B. Mears and C. D. Brown, *Corrosion*, Sept. 1945, pp. 113–118:—Reviews the theoretical advantages of Al and Mg as compared to Zn and concludes that a long-range field investigation is advisable.

**Use of Zinc for Cathodic Protection.** H. W. Wahlquist, *Corrosion*, Sept. 1945, pp. 119–147:—Character of corrosion products on Zn anodes buried in various types of soil; changes in film potential; effect of impurities in Zn; local action currents from different soil strata; effect of current density; tests on gas lines.

**Corrosion Resistant Sucker Rods.** *Corrosion*, Sept. 1945, p. 148:—Cites excellent performance records of a nickel plated sucker rod and a rod made of a Cu-Ni-Al alloy, both installed experimentally in highly corrosive wells.

**Corrosion of 18-8 Alloy Furnace Tubes in High Temperature Vapor Phase Cracking Service.** E. O. Camp, Cecil Phillips, and Lewis Gross, *Corrosion*, Sept. 1945, pp. 149–160:—Detailed report of a laboratory investigation of corrision experienced in tubes in the naphtha circuit of the superheater furnaces at a butadiene plant. Research indicated that corrosion could be eliminated by addition of small amount of either sulphur (as free sulphur, carbon bisulphide, butyl mercaptan, etc.) or water to the naphtha charge; results fully confirmed in plant.

**How to Protect Motor and Machine Components.** L. G. Klinker, *Iron Age*, Oct. 15, 1945, pp. 64–68:—Expedients by which corrosion is minimized in such equipment.

# FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

**GENERAL HEADQUARTERS** of mid-western beet sugar craftsmen, young and old, centers in Denver. There is rivalry between the divisions of the technologists. The factory operators strive to excel and claim priority in the consideration of appropriations. On the other hand the agronomists also strive for preferred esteem. The argument assumes the nature of the relative priority of the chicken and the egg. Nevertheless President Benning of Amalgamated propounds that no sugar factory ever suffered financial collapse from a superfluity of beets. When the pessimists view with alarm the various sources of competition that edged in while sugar was scarce, such as substitutes from corn and wheat and artichokes as well as the Washington bureaucratic urge to reduce sugar consumption for pathological reasons, Benning comes across with the proposition that " the people like sugar and, by golly, so long as they buy double vanilla sundaes covered with strawberries smothered with powdered sugar, the industry is safe."

**A POPULAR HOBBY** of "sugar tramps" in Denver is wood craftsmanship. The cellars are generally equipped with beautiful electric-driven wood working machinery and here fine inlaid furniture is designed and built. Some day the names of George Rienks (Chief Engineer of Great Western) and George Shaffer (Asst. General Supt., Retired) will be added to Chippendale! Rienks avers that working with the hands at a skilled task provides mental relaxation and removes the cobwebs.

At the beginning of the War the War Department needed many scale models of airplanes for instruction. Rienks spent his entire spare time on this task. For 1/15 x 1/32-in. brace rods he dowelled in 1/16-in. rounds and after the glue was dry he filed them into the required rectangular cross section. Henry Schmode, retired engineer and superintendent, was brought from Germany in 1893 to install the pioneer Steffen separation process in Norfolk, Neb. Since sugar manufacture is a chemurgical process, he naturally drifted into farming as a retirement hobby. Just before the war he purchased a new car for his daughter and her husband. When gas rationing was instituted he added two bicycles with prewar tires.

**MAINTENANCE OF VIRILITY** of mind and body is also practiced by the womenfolk. Fifteen years ago Gradmother George Shaffer (then aged 60) sought to purchase a plaque containing a red rose with a background to fit a particular decorative purpose. The artist found the rose but the background did not inspire satisfaction. He promptly took the plaque and Mrs. Shaffer to the studio and with a few dextrous strokes of the brush, he produced exactly what was desired. The process seemed so simple that Mrs. Shaffer immediately matriculated with a class of learners in clay modeling and painting. Now after 15 years of practice she has acquired a high order of skill as reflected in decorations of her home. She even fulfills professional commissions in competition with her former instructor. For mental discipline she pursues activity in a neighborhood improvement club where reading and debating are practiced.

Mrs. Hamilton, wife of the late superintendent of the Burlington in Nebraska, was stricken with the curiosity to experience the feel of a college education. Accordingly she matriculated as a freshman with her elder son at the University of Nebraska and finished as a senior with her younger son eight years later! The purpose of thus dragging the behavior of the wives of engineers into a man's magazine is to bring out an unadvertized contribution to the "old man's" technological and human success. Moreover a vigorous avocation improves the performance in the routine job. It promotes method and effort against the bread-and-butter tasks so as to conserve time for the luxury of the hobby.

**EDWIN MORRISON**, the distinguished engineer emeritus of the Great Western Sugar Co., spends his summers in his swiss chalet located at Gould, Colo., near the Rabbit Ears Pass of the continental divide. He picked out the spot, nearly two miles above the sea, years ago when he used to make an occasional fishing and hunting trip to this region. Then he designed his house with the large friendly fireplace, detailing it log by log and started construction about 20 years ago. Cold mountain water for the house, garden and chickens, comes by gravity assisted by a windmill. Electricity is generated by an automatic gasoline engine.

Morrison's outstanding characteristic is his scruplous regard for schedule. His inspection trips were always governed by a predetermined agenda. After his retirement he laid out an automobile pleasure trip to Florida. The daily stopping points were carefully set down in his time table. When he contemplated the completed schedule he knit his brows and expressed concern lest the distances between hostelries might cause hardship for "he was after all an old man!" George Rienks ventured to suggest that if he came to an attractive place that promised comfort, he could linger and relax. Morrison's mind could not encompass such departure from plan and he replied, "But damit, man, how can I! I'm on schedule!"

In anticipation of the chronicler's visit in July, Mrs. Morrison and her sister donned hip boots and went fishing. They brought back a generous mess of mountain trout which they fried in butter. All of the accessories except bread and sugar were grown at home, including the flowers. Thus the matter of ration points was not disturbed by the arrival of unexpected guests.

**ACQUISITION OF THE RIGHTS** and benefits of membership in the clan of "sugar tramps" is in many cases accompanied by some drama and heavy effort. Fred Treadway started toward the goal of boss of the Longmont House at a youthful age about forty years ago. Small of stature and wiry as an eel, he got in line at the opening of the campaign about 75 numbers from the timekeeper's gate. Urged by impatience he slipped through between the legs of the big fellows ahead and got under the turnstile unnoticed. A week later the timekeeper discovered him vigorously at work.

**PRESIDENT HEYWOOD LEAVITT** (Harvard '82) was a gentleman of culture. His father sent him fresh from college to the wilds of Grand Island, Neb., to operate the village gas plant and administer one of the family farms. His four years of college football and boxing had developed a skill that proved useful. On an occasion during the construction of the Ames factory, he was conducting a party of New York "bondholders" through the works. As he passed the construction shanty, the rough, sulphurous language of an unhappy hobo, just back from Fremont with a hangover, was exploding in a quarrel with timeclerk Stevenson. Leavitt projected his head into the door to ascertain the cause of the unseemly language. The answer was prompt. "None o' yer — — business, you blankety blank so and so!" Leavitt met the challenge. Presently the hobo, sore of body, contrite of spirit, and black of eye admitted that he was in the wrong and left the reservation.

**IN THE VICINITY** of Scottsbluff the farmers dug small irrigation ditches but were unable to encompass the task of coordinating the scattered operations into a comprehensive project. Leavitt bought the rights from the farmers under court approval and organized the Tri-State Irrigation Co. Applying his vision he made big plans and his persuasive skill attracted large capital subscriptions. He forsaw great agricultural activity and planned to develop beet culture at Scottsbluff, Bayard, Gering, Mitchell and elsewhere. However his lack of administrative capacity discouraged his backers. They lost confidence and withdrew their support at the most inopportune time. Leavitt applied for funds in Omaha. The bankers requested a list of the stockholders. The names of the New York financiers overwhelmed

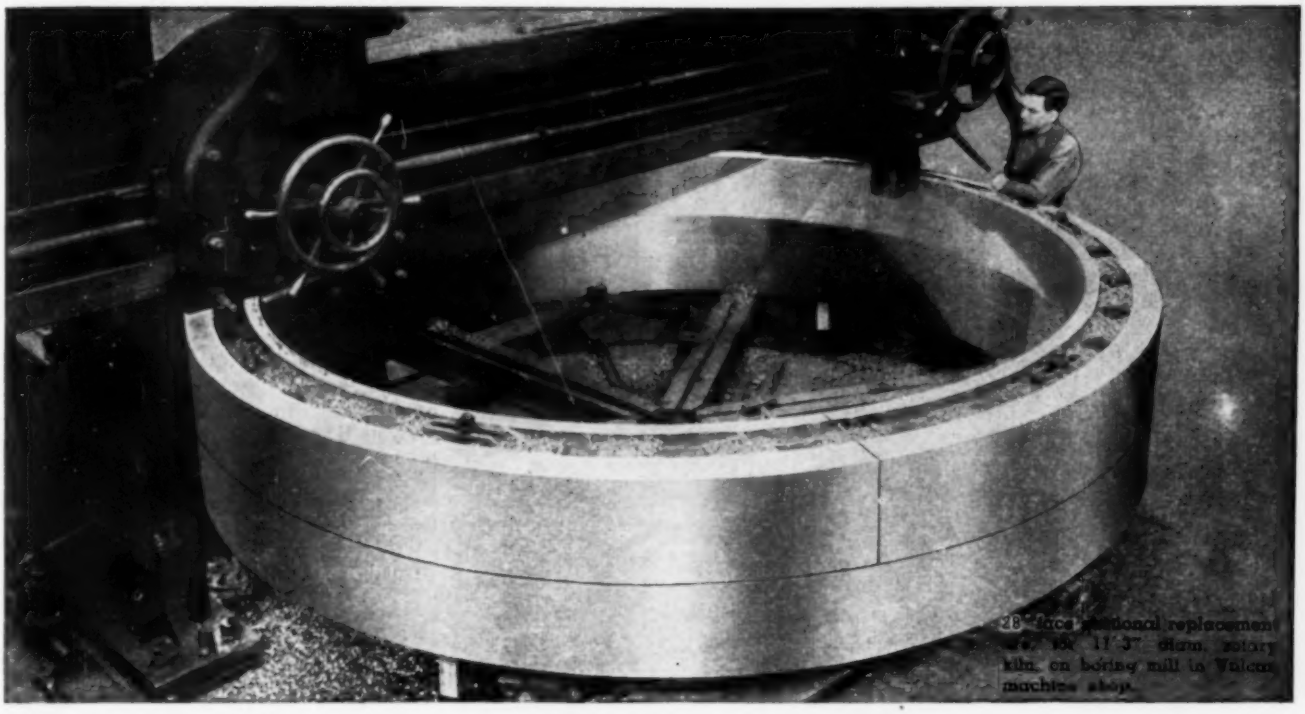
them and they referred Leavitt to his own stockholders. Eventually the strong treasury of the Great Western Sugar Co., backed by H. O. Havemeyer, came to the rescue. They bought Leavitt's factory at Ames, moved it to Scottsbluff, and proceeded to build factories and develop an agricultural paradise exactly as Leavitt had visioned it.

**WHEN THE AGE LIMIT** retired Hugh Scilley from the management of the Loveland factory he gave up fishing and took up the operation of cattle ranches, a bank directorship, and the organization of a Building and Loan Association. No time remained from the old hobby of fishing, although he lives within a stone's throw of the finest trout streams in the Rocky Mountains. The chronicler first met him when he was secretary to the manager of the Standard Cattle Co. at Ames, Neb. The company was building a beet sugar factory at a spot named Leavitt, after the president of the sugar project. A large airy barn served as organizing headquarters till bunk houses and community conveniences were constructed. Then came the roving constructors, mostly hobos, the kind who carved their monikers into the wooden structures along the railroad right-of-way. The sugar company erected a general store to facilitate the pursuit of happiness. No liquor was permitted to be sold on the premises but teetotaling Leavitt in his innocence overlooked patent medicines!

Hugh Scilley sensed the need of spiritual guidance and accordingly organized a mission and Sunday school to which he contributed earnestly and generously of his time. He acquired appointment as justice of the peace and was thus in a position to provide every social service from the cradle to the grave. Young Ball, assistant to timekeeper Al McMeans, was stricken with an inspiration to marry. This was not an uncommon affliction nor was the chronic depletion of the wallet unusual. However there was a solution to all perplexities. Ball had the girl, Herman Miller took care of the minimum financial requirements by advancing $5, and Hugh Scilley pronounced the benediction legally and clergically.

**BEWITCHING JOE BERRY,** assistant superintendent of the Loveland staff of sugar makers put in a campaign in Rocky Ford in '02 when Doc L. M. Lawson was superintendent. Joe reported for duty Christmas Eve and found only a handful of men on the job. Even Doc himself was absent from his post. Everybody was drinking eggnogs. So Joe followed the trend. At the tavern he ran into Doc and received a cold stare but no word of greeting. Later at the plant the watchman informed Joe that he was wanted at the superintendent's office. Instead, Joe caught the next freight for Loveland where he has been ever since. This episode goes to show how a small eggnog and the circumstances of Christmas Eve can change the course of history.

**PROPAGANDA** for the promotion of the sale of paper bags for one-time filling requires attendance (accompanied by a certain lavishness) at conventions of specialty groups in whose activities bags are used. Thus Dick Procter, master paper bag salesman, sat in with the association of "chickenologists" at the Atlantic City Convention a



28" face sectional replacement tire, 168" [illegible] 11' 3" diam. rotary kiln, on boring mill in Vulcan machine shop.

# Here's One Good Reason—why

# VULCAN CAST-STEEL SECTIONAL TIRES

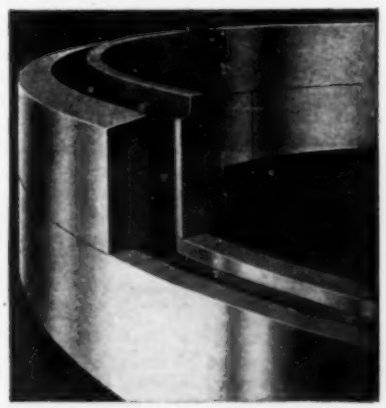
## Always Give Dependable Service

The fact that every Vulcan Sectional Tire is completely assembled before final accurate machining is only one of many reasons why they always give good service when used to replace solid tires on a rotary kiln or dryer. Another reason is that they are always cast in circular form—the upper and lower halves being cast separately and then cut into semi-circles to make the four component parts.

Additional reasons include slow annealing at moderate temperature, to eliminate internal strains while still retaining the necessary strength and hardness to stand up under long-continued severe service.

Naturally the first cost of a Vulcan sectional tire is more than that of an equivalent solid tire, but on most replacement jobs the saving in installation costs—plus the saving in shut-down losses—is so great that no responsible executive can afford to overlook their ultimate economies.

If you operate rotary kilns, coolers, dryers or retorts, you may easily achieve important savings by ordering Vulcan Sectional Tires NOW and having them ready to slip on before trouble actually develops.



Close-up of tongue-and-groove joints on Vulcan sectional tire shown above. Bolt holes through the tire sections are reamed for 2" fitted bolts, with hex and jam nuts, and a dowel pin is used at each of the four end-joints.

## VULCAN IRON WORKS, Wilkes-Barre, Pa.

Rotary Kilns, Coolers and Dryers
Rotary Retorts, Calciners, Etc.
Improved Vertical Lime Kilns
Automatic Quick-Lime Hydrators

Toothed, Double-Roll Crushers
High-Speed Hammer-Type Pulverizers
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Heavy-Duty Electric Hoists
Self-Contained Electric Hoists
Scraper-Loading Hoists
Cast-Steel Sheaves and Gears

Steam Locomotives
Diesel and Gasoline Locomotives
Diesel-Electric Locomotives
Electric Locomotives and Larrys

few years ago. Dick well understands the profit of associating his sales effort with the pleasant surroundings of the banquet table, especially with the dispensation of the concluding formality generously absorbed by his House. Accordingly he paired off with an important farmerette (blond) who was the manager of an extensive chicken farm. The cocktail was enjoyed along with small conversation by way of sparring for a subject of mutual interest. Then followed the inevitable shop talk. The farmerette complained that she annually suffered great loss because of contagion conveyed by infected feed. This came about, she said, by the re-use of costly bags of woven fibers which had delivered feed to farms of diseased chickens and were subsequently returned for credit, refilled and sent back to the trade. These bags possess high structural strength, long life and high salvage value. At this point Dick brought in his heavy artillery with the suggestion that she should specify his single service paper bags. Replied the blond, "What! And lose the return value of 25c. per bag!"

**ON A RURAL BRIDGE** job in 1914, the county supervisor exercised his perquisite and appointed a fellow farmer as inspector. The inspector's arithmetic could not cope the intricacy of proportioning the concrete materials. Accordingly he stuck his finger into an occasional batch and judged by the smell that it was good. He condemned not a single batch.

**THROUGH THE INTRODUCTION** of General Manager W. L. Lawson of the Holly Sugar Corp., Harold Silver met Fred Roberts, who backed him to the extent of matching his own savings of $2,500. With this Harold proceeded to develop a brainstorm into a beet handling machine. Through Lawson he obtained a contract to build it for the Worland factory subject to a guarantee backed by deferment of pay till the end of the harvest. The lawyer who prepared the organization agreement told him cheerfully, "If you don't make it, you'll just have to go out with your umbrella and rubbers." Harold put all his money and effort into the building of "the last word." About two weeks before the harvest he secured a truck load of beets for trial. The machine was a flop and all of his money was in it! He spent some feverish nights evolving a revision. Then he put his predicament up to Supt. McLeod and asked him if he would take a chance and stake him to two or three hundred dollars' worth of supplies and labor. Mac told him to go to it. When the harvest came, Harold had finished the revisions and the machine was a complete success.

**THE MODERN FARM TRACTOR** operated by a beauteous maid has completely replaced the old steam engine with drums and steel cables that used to drag wide reversible gang plows alternately back and forth across the fields. As recorded in a local paper in March 1898, "The steam drum of the engine operating one of the plows on the King City (Calif.) ranch exploded on Tuesday afternoon and a flying splinter fractured the skull of S. B. Horner. It will take about two weeks to repair the machinery."

# NAMES IN THE NEWS

H. E. Fritz

D. P. Morgan

C. E. Finney, Jr.

**Howard E. Fritz** has been elected to a new post in the B. F. Goodrich Co. with the title of vice president-research. Dr. Fritz, who has been with Goodrich since 1925, will continue to head its research activities for which a new research center is to be constructed.

**John C. Warner,** of the Carnegie Institute of Technology, a leader in the development of the atomic bomb, has received the Pittsburgh Award for outstanding service to chemistry in 1945. The annual award is sponsored by the Pittsburgh Section of the American Chemical Society and presentation took place at a dinner in Pittsburgh's University Club on February 21.

**John R. Ellstrom,** until recently a lieutenant in the U. S. Naval Reserve, has rejoined the Quaker Chemical Products Co., Conshohocken, Pa., where he will serve in the Technical Service Division of the Company.

**E. F. Kindsvater** has been named manager of the newly created Chemical Engineering Department of Phillips Petroleum Co., Bartlesville, Okla. **P. M. Arnold** is assistant manager. There will be centralized in this new department the chemical engineering operations now being carried out by the personnel of the Research and Development Department.

**Ben H. Parker,** former vice-president of Frontier Refining Co., has been named president of Colorado School of Mines, Golden, Colo. Previously a member of the faculty of the school, Dr. Parker succeeds **F. M. Coolbaugh,** who has retired.

**William R. Watson** has returned to the Special Chemicals Division of the Pennsylvania Salt Manufacturing Co., after service in the Pacific as a Naval lieutenant. Two trainees also have joined the division. They are **H. Roper Davis,** formerly with the Fercleve Corp., and **John W. Beaver,** recently discharged from the Army Air Force and formerly with the B. F. Goodrich Co.

**D. P. Morgan,** until recently director of the Chemicals Bureau of WPB, has joined W. R. Grace & Co. where he is in charge of chemical market research and development. In government service throughout the war, Dr. Morgan held various positions in which he dealt with problems relating to the production and distribution of chemicals.

**Alfred R. Smith,** a chemical engineering graduate of the Polytechnic Institute of Brooklyn formerly employed by the Chemical Construction Corp. in Canada, has rejoined the company after service in the Armed Forces and is located in Linden, N. J.

**Roger Adams,** head of the Department of Chemistry in the University of Illinois, has been awarded the Davy Medal of the Royal Society of London. Dr. Adams was cited for researches in organic chemistry and recent work on alkaloids.

**Philip S. Winnek,** formerly director of research at Pitman-Moore Co., Indianapolis, has joined the research department of Commercial Solvents Corp., at Terre Haute.

**George A. Fisher, Jr.,** is the director of the recently opened St. Louis Technical Section of the Development and Research Division of the International Nickel Co. Mr. Fisher is a chemical engineering graduate of Purdue University.

**Oscar A. Mockridge** has joined the Chemical Engineering Development staff of the Insulation Division of Eagle-Picher Sales Co. of Cincinnati. Mr. Mockridge will make his headquarters in Joplin, Mo.

**C. H. Doherty, Jr.,** has been named production manager of the ammonia department of E. I. du Pont de Nemours & Co., to succeed **J. L. E. Cheetham,** who has retired.

**Carl A. Zapffe,** metallurgist, has opened a consulting office and research laboratory at 6410 Murray Hill Road, Baltimore, Md.

**C. E. Finney, Jr.,** recently elected vice president of Standard of California, will be concerned with industrial relations matters in his new position. A graduate of Cornell University, Finney joined Standard of California in 1919 at the company's refinery in Richmond, Calif., and subsequently was manager of the El Paso refinery of Standard of Texas; manager of the Richmond, Calif., refinery; and general manager of Standard of California's manufacturing department.

**M. C. Brunner** has rejoined Shell Oil Co., Inc., as administrative assistant for the Texas-Gulf area in the office of the vice president in Houston. Brunner is a graduate of California Institute of Technology and has been with Shell since 1926. He has recently returned from Army service.

**Clarence F. Hansen,** former chief engineer of Standard Oil of California's manufacturing department, has been made president of the newly formed American Gilsonite Co., equally owned by Standard and the Barber Asphalt Corp. Mr. Hansen, a graduate of the University of Wisconsin, has been with Standard since 1920. His headquarters will be in San Francisco.

**Phillip S. Magruder,** who has been with General Petroleum Corp. since 1925, was recently made vice president of the company. He was formerly one of the operators of the California Natural Gasoline Ass'n.

**Harlan A. Depew,** formerly manager of the Fluoride Titanium Plant at Gloucester City, N. J., has joined the technical staff of the Flintkote Co.

**Martin Leatherman,** a former major in the Chemical Warfare Service Technical Command, has joined the Pennsylvania Salt Mfg. Co., where he will be in charge of development and evaluation of new and improved textile chemicals. Other new staff members are: **Robert H. Tiers,** formerly with Pratt & Whitney Aircraft Corp.; **W. J. Knapp,** formerly with North American Cement Co, and

recently in the U. S. Navy; **Glendon B. Kyker**, formerly with Hooker Electrochemical Co.; **H. A. Kraftson**, formerly with E. I. du Pont de Nemours & Co.; **Frederick D. Loomis**, recently released from the Army; **Peter Zappasodi**, chemist at Pennsalt's Philadelphia plant; and **E. J. Nolan**, formerly with Rohm & Haas Co. These eight new researchers have joined the staff in an expanded postwar research program and will round out the research being done in textile chemicals, metal cleaners, and related materials, ceramic chemicals and other developments in various Pennsalt products.

**Arthur L. Jacoby** has been named assistant director of research for the National Aluminate Corp., Chicago. Dr. Jacoby is a chemical engineering graduate of the University of Illinois and has been with the National Aluminate Corp. since 1938 as chief organic chemist.

**James G. Sanders**, entomologist, is now associated with Commercial Solvents Corp. where he will engage in developing markets for insecticides and allied products.

**Olaf P. Bergelin** has been appointed assistant professor of chemical engineering at the University of Delaware. Dr. Bergelin was a captain in the Corps of Engineers and recently associated with the Manhattan District. At Delaware he has taken over direction of a cooperative research project on heat exchangers.

**Joseph J. Mattiello**, vice president and technical director of the Hilo Varnish Corp., has been presented with the Meritorious Civilian Service Award for outstanding service as a member of the Advisory Board of the Military Planning Division, Office of the Quartermaster General.

**Josef D. Zeller** has been advanced to the post of associate technical director by Godfrey L. Cabot. Mr. Zeller is a chemical engineering graduate of the University of Alabama and was previously with the U. S. Rubber Co., Detroit.

**Lee Wiltsee** has retired as vice president and treasurer of the William S. Merrell Chemical Co. after 52 years with the company. He will continue as a director.

**R. H. McCarroll**, of the Ford Motor Co., has been promoted to the post of executive engineer. **John McCloud** has been named to succeed Mr. McCarroll as head of the chemical engineering department.

**Martin H. Fischer** has been selected to receive the 1946 Award of Merit of the Miami Valley chapter of the American Institute of Chemists.

**Bernard Lewis** has been promoted to the post of chief of the Explosives Division of the Bureau of Mines.

**J. M. Sharf**, a chemical engineering graduate of Iowa State College has been named chief of closure research for Armstrong Cork Co., Lancaster, Pa.

**F. H. Winslow**, formerly associated with the Manhattan District Project, and **R. D.**

**Heidenreich,** formerly of the Dow Chemical Co., have become members of the technical staff of the Chemical Laboratories of Bell Telephone Laboratories, Murray Hill, N. J.

**James McWhirter** has been named superintendent of the Natrona plant of the Pennsylvania Salt Mfg. Co., to succeed **Charles G. Boone,** who has retired.

**C. J. Ramsburg,** vice-president, Research Division, Koppers Co., has retired.

**Wallace P. Cohoe** has been awarded the Messel Medal of the Society of Chemical Industry. The award will be presented at the annual meeting of the society in London July 12.

**Robert R. Williams,** chemical director of Bell Telephone Laboratories for more than 20 years has retired from his post of chemical consultant at the laboratories.

**John G. Kressman** has joined Bristol Laboratories at Syracuse, N. Y., after service with the armed forces where he attained the rank of major.

**Michael J. Blew,** former research engineer for the Philadelphia Bureau of Engineering, has been awarded the Fourth Service Command Certificate for meritorious service. Before entering the service, Colonel Blew was connected with the city bureau for 18 years. He is a member of AIChE.

**Carl Iddings** has formed a new company for production of water paints. The Iddings Paint Co. plant is located in Long Island City. Mr. Iddings was formerly vice president and general manager of the Muralo Co., and recently president of the Prescott Paint Co.

**Edwin L. Hobson, III,** has been released from active Army duty. Lt. Col. Hobson was chief of the plastics section, Research and Development Branch, Office of the Quartermaster General. Prior to entry into the Army he was with the Bakelite Corp. and last January he was awarded the Legion of Merit for his work in plastics development.

**Leonard F. Hartmann,** a former major with the combat engineers in France and Germany, has been appointed research assistant in the chemical engineering department at Kansas State College for a 12-month period. Mr. Hartman is a chemical engineering graduate of Michigan School of Mines. His work will include a research project of the fundamentals of spray drying.

**Robert E. Burks, Jr,** has been granted a leave of absence from Southern Research Institute, Birmingham, in order that he may resume at the University of Wisconsin postgraduate studies interrupted by service in the Navy.

**Ridgley G. Shepherd, Jr.,** formerly chemical engineer with the Polaroid Corp., has joined the Chemical Engineering Research Staff of Gustavus J. Esselen, Inc., Boston.

**Nelson A. Howard, Jr.,** recently returned from duty in the Aviation Branch of the Naval Reserve, has joined the new market development field of A. R. Maas Chemical


Photo Winthrop Chemical Co., Inc.

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**Purified Ammonium Sulfate** by *B&A* is a white granular product assaying 99.0% min. $(NH_4)_2SO_4$, which is eminently suitable for industrial micro-biology and the preparation and manufacture of medicinals.

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**Co.**, South Gate, Calif. Howard was formerly with the Azusa, Calif., office of American Cyanamid & Chemical Corp.

**Earl A. Long**, former assistant director of the Los Alamos atomic bomb laboratory, has been appointed a professor in the University of Chicago's new Institute for the Study of Metals.

**William G. Neall** and **Carl G. Erikson**, chemical engineers, have been added to the staff of Arthur D. Little, Inc., after service with the armed forces.

**J. Warren Kinsman**, general manager of the Fabrics and Finishes Department of E. I. du Pont de Nemours & Co., has been elected to the board of directors as successor to **John J. Raskob** who has resigned.

**Maurice F. Dufour** has been promoted to the position of general manager for the Nicaro Nickel Co., a subsidiary of the Freeport Sulphur Co.

**George G. Lamb**, recently discharged from the Navy where he coordinated research on aviation fuels, has been made professor of chemical engineering at the Technological Institute of Northwestern University.

**Axel Heilborn** of the Niagara Alkali Co. has been appointed technical director in charge of research and engineering.

**Harlan L. Trumbull**, directo rof synthetic rubber and textile research of The B. F. Goodrich Co., will serve as manager of the research and development division, synthetic rubber department, Rubber Reserve Corp. in Washington, D. C., on a temporary basis.

**F. A. Burningham**, chemical engineering graduate of the University of Minnesota and formerly with the Brown Co., Berlin, N. H., has joined the staff of the Institute of Paper Chemistry.

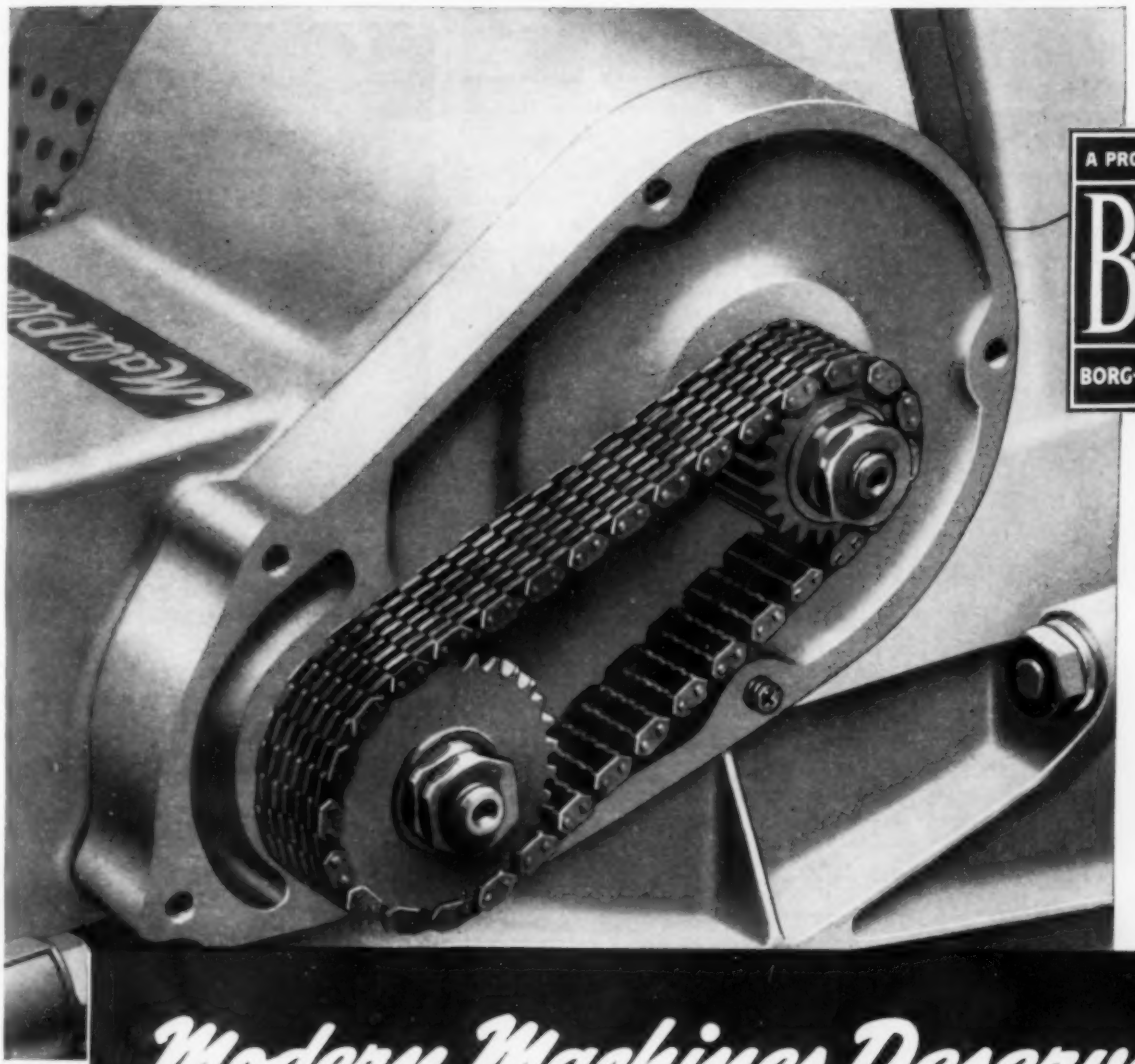
**Jacquard H. Rothschild**, colonel in the Chemical Warfare Service, has presented with Legion of Merit in recognition of outstanding war service to the CWS. Presentation was made by Major-General Alden H. Waitt, chief of the Chemical Warfare Service.

**T. H. Daugherty** has rejoined his old company, Hall Laboratories and Calgon, Inc., as assistant to the director of research. Lt.-Col. Daugherty is now on terminal leave.

**Lyle E. Calkins** has been appointed head of the chemical laboratories of Willys-Overland Motors. Prior to joining Willys in 1943, Calkins was superintendent of the Libbey Glass Co.

**John F. Wilkes** has been named technical director of Dearborn Chemical Co.'s railroad department in Chicago. Major Wilkes returned to Dearborn after four years' service with the Army Signal Corps.

**Allen B. Lemmon** has recently been appointed chief of the Bureau of Chemistry, California State Dept. of Agriculture, Sacramento. A graduate of Stanford University

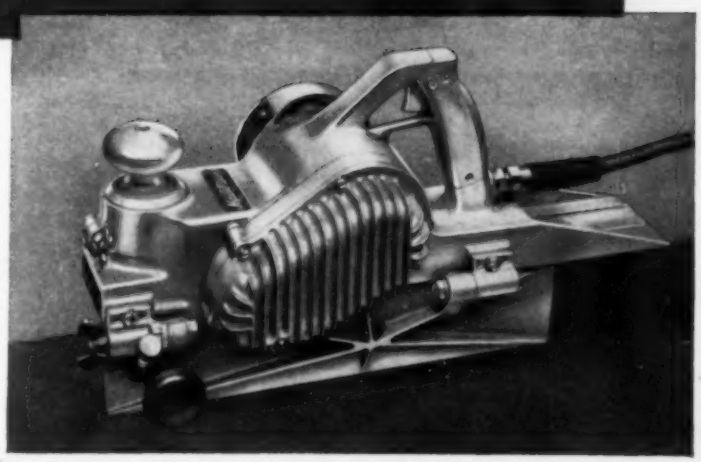


A PRODUCT OF

B-W

BORG-WARNER

# *Modern Machines Deserve Morse Drives...*



**Only chain can assure the positive drive a surface sander must have. On Mall Tool Company's Sander, Morse 3/16-inch pitch Silent Chain, in a compact assembly, using teeth not tension, gives maximum drive efficiency. MORSE CHAIN CO., ITHACA, N. Y., DETROIT 8, MICH.**

# MORSE ROLLER and SILENT CHAINS

SPROCKETS • FLEXIBLE COUPLINGS • CLUTCHES

school of engineering, Mr. Lemmon has been with the Bureau for more than ten years, having been district inspector in Sacramento for about five years. He succeeds **Alvin J. Cox,** who retires.

**S. W. Martin** has joined the technical staff of the Portland Gas & Coke Co. as assistant vice president in charge of new products development. He was formerly head of the chemical section of the Institute of Gas Technology, Chicago.

**Leroy A. Thomson** has resigned as vice president and general manager of the Bump Pump Co., La Crosse, Wis.

**James E. Dougherty,** recently discharged from the Army, has joined the staff of the Institute of Textile Technology, Charlottesville, Va., as a laboratory technician.

**Fred E. Dole,** until recently engaged in war research work in the Radiation Laboratory at M.I.T., has been appointed technical representative and research consultant for the J. M. Ney Co., Hartford, Conn. In his new position, Mr. Dole is particularly concerned with Ney's precious metal alloys.

## OBITUARIES

**Charles Borland,** 68, president of the Federal Electric Co., Chicago, died January 3

**N. Arthur Laury,** 69, a production executive of the Calco Chemical Division, American Cyanamid Co. before his retirement last year, died in Florida January 26.

**Emil H. Schellack,** 60, vice president and director of sales for the Upjohn Co., died February 12.

**Arthur R. Haley,** general manager of the Pittsburgh Plate Glass Co.'s. Columbia Cement Division, died in Zanesville, Ohio, February 14.

**John J. Brown,** 73, chairman of the boards of Foster Wheeler Corp., New York, and Foster Wheeler, Ltd., Ontario, died in New York, February 15.

**Ernst Berl,** 68, well-known chemical engineer, explosives expert, and contributor to *Chem & Met.*, died in Pittsburgh, February 16.

**Leonard H. Davis,** 73, consulting engineer of Union Carbide and Carbon Corp., died in New York, February 19.

**Gustav Jarecki,** 78, founder of the old Jarecki Chemical Co. of Cincinnati, died in Clifton, Ohio, February 22.

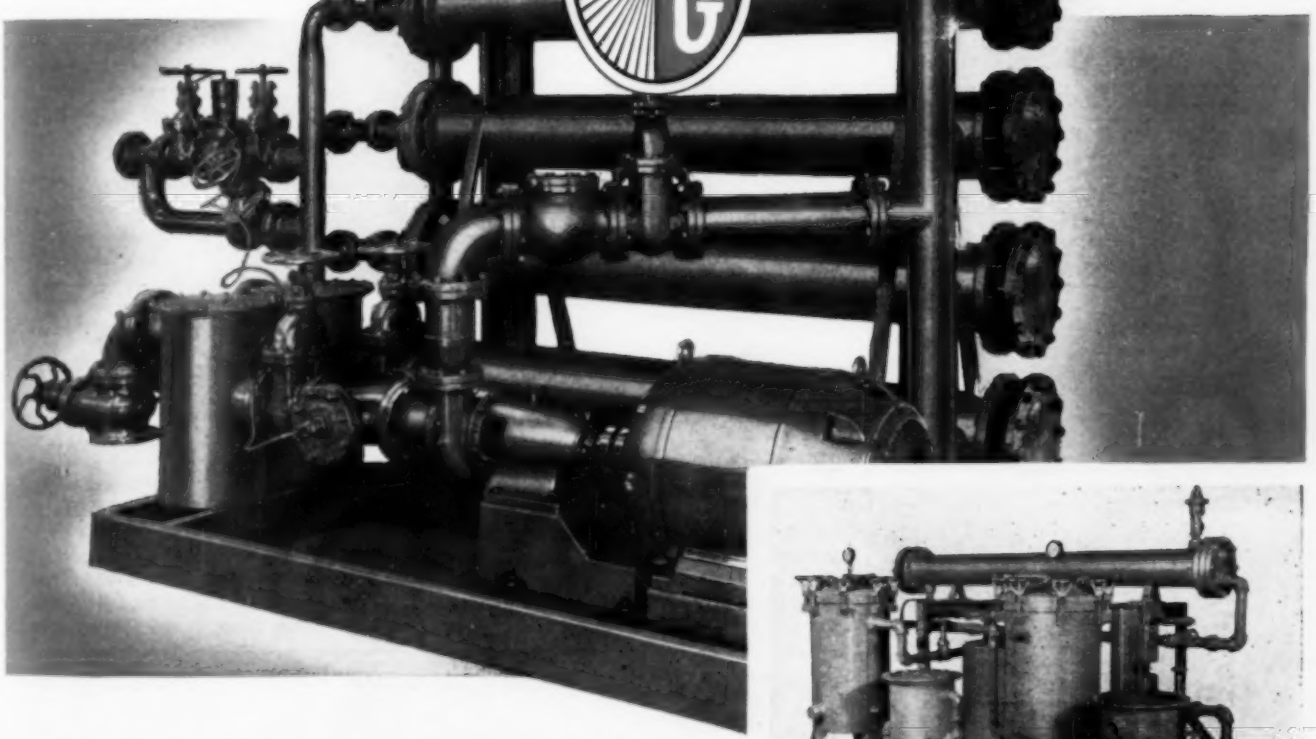
**William C. Bray,** 66, authority on inorganic chemistry and professor at the University of California, died in Berkeley, Calif., February 24.

**Laurence E. May,** 51, nationally known chemist of the Sherwin-Williams Co., died at LaPorte, Ind., March 1.

**Henry McSweeney,** 91, president of the United States Potash Co., died at his home in Atlantic City March 5.

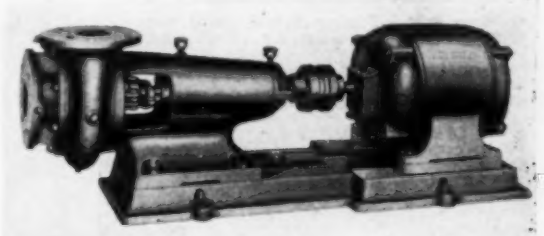
# HEAT EXCHANGERS

*by*





*Hot oil coming from engine test blocks is cooled and strained in this B & G Self-Contained Cooler Unit.*

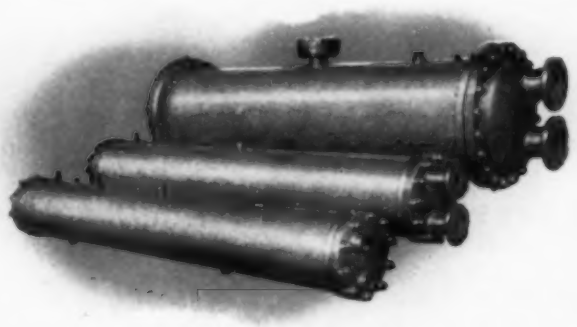


*B & G Type "W" Centrifugal Pumps are rugged, compact units, available with semi-open or enclosed impellers, motors flexible coupled or integral with pump. Send for Catalog CP-843.*

For efficient heat transfer between liquids and gases, the Bell & Gossett Company offers soundly designed equipment *plus* a helpful engineering service . . . competent, experienced and with a long record of successful designing to specific needs. Whether you are planning to modernize present equipment or are experimenting with new ideas for faster production and better quality, there is no obligation involved by a consultation with B & G engineers.

B & G Heat Transfer Products can be furnished either as separate items or as self-contained units complete with Heat Exchangers, Pumps, Controls and other necessary auxiliary equipment. In either case B & G equipment can be depended upon to handle materials efficiently and with assurance of uniform results.

Your request for information will receive prompt attention.



*All refrigeration components manufactured by B & G conform to the ASME Code for Unfired Pressure Vessels.*

**B & G REFRIGERATION COMPONENTS**

A very flexible line of direct expansion evaporators, condensers, liquid receivers, combination liquid receivers and subcoolers for refrigeration purposes are now available. Special alloys may be incorporated in the fabrication for those critical heat transfer applications when requested.

## BELL & GOSSETT CO.

**DEPT. L-14, MORTON GROVE, ILLINOIS**

# INDUSTRIAL NOTES

**Pittsberg Chemical Co.,** Los Angeles, Calif., a co-partnership has recently incorporated under the name of Eston Chemicals, Inc. There has been no change in the management or general operation of the company.

**Blaw-Knox Co.,** Pittsburgh, Pa., has renamed the Baum Boulevard division of the company to chemical plants division, in order to identify it more closely with the purpose for which it was originally organized. The division is headed by E. W. Forker, vice president in charge of process equipment.

**The International Nickel Co., Inc.,** New York, has opened a St. Louis technical section of its development and research division. The new section under the direction of George A. Fisher, Jr. will furnish technical assistance in Missouri, southern Illinois, southwestern Iowa, northern Arkansas, western Tennessee and Nebraska and Kansas.

**Hammond Iron Works,** Warren, Pa., has appointed Oilman's Service and Supply Co., Boston, Mass. as its New England representative. P. M. Kline Co., Cleveland, Ohio will represent the company in the Cleveland district.

**Star Electric Motor Co.,** Bloomfield, N. J., announces the opening of a New England district office at 1430 Massachusetts Ave., Cambridge, Mass. Elliot W. Knight has been appointed district manager.

**Freeport Sulphur Co.,** New York, has named J. G. Baragwanath director of exploration. Mr. Baragwanath will head Freeport's new program to find and develop mineral resources in any part of the world. Exploration headquarters have already been established in the United States, Canada and South Africa.

**Wyandotte Chemicals Corp.,** Wyandotte, Mich., has named L. D. Dodson, manager of the department of public business, to head the company's calcium chloride sales. He will continue to operate from the Wyandotte office.

**American Cyanamid Co.,** New York, has announced that Roland V. Tailby, has been made personnel manager of the Calco chemical division.

**American Welding & Mfg. Co.,** Warren, Ohio, announces the appointment of W. D. Cleavenger as Chicago district manager. He will make his headquarters at 332 S. Michigan Ave., Chicago.

**Libby-Owens-Ford Glass Co.,** Plaskon Division, Toledo, Ohio, announces that L. Choyce, has become advertising manager with headquarters in Toledo. E. P. Botsford, new manager of the company's New York office also will handle sales promotion work. Other appointments include H. W. DeVore, district manager, and J. Ferguson, service engineer, central area, with headquar-

ters in Chicago; J. S. Lauber, as office manager, Toledo; J. A. Joyce, district manager, middle Atlantic area; R. M. McGee, district manager, New England area; C. B. Wing, district manager, upper New York area.

**Hercules Powder Co.**, Wilmington, Del., has promoted Frank G. Oswald to be assistant sales director of the synthetic department. He will assist in the general sales policy, sales training and in coordination of technical sales activities.

**Philadelphia Quartz Co.**, Philadelphia, Pa., has announced the advancement of John C. Russell to the position of sales manager. Carl F. Wolcott has been named manager of foreign sales. Other appointments include Russell J. Emmons, industrial relations manager and John H. Wills assistant patent manager.

**Witco Chemical Co.**, New York, announces acquisition of the Franks Chemical Products Co., Brooklyn, N. Y. No change will be made in the present management and Joseph M. Franks will continue as president. The company will be known as the Franks chemical products co., division of Witco Chemical Co.

**Hersey Mfg. Co.**, South Boston, Mass., has concluded an arrangement with the Westinghouse International Electric Co., New York, whereby all sales for the drying divisions, exclusive of the United States and Canada, will be handled by the Westinghouse company.

**The Duraloy Co.**, Scottdale, Pa., announces the appointment of Max Miller of Detroit as sales manager. He was formerly with Duroloy's representatives, F. B. Cornell & Associates, in a sales engineering capacity.

**Chemical Coating Corp.**, New Britain, Conn. has been formed to manufacture specialized industrial coatings, lacquers and certain finishes. A new plant for fabrication of materials is planned for the immediate future. Edward H. Christ will head the new firm.

**Swope Oil and Chemical Co.**, Philadelphia, is the name of a new company resulting from the merger of M. C. Swope and the W. A. Briggs Bitumen Co. The new company has started an expansion program.

**Link-Belt Co.**, Chicago, reports that Joseph J. Gilbert has returned to the company from his wartime service with the United States Army Sanitation Corps, where he attained the rank of lieutenant colonel. Mr. Gilbert will be sales engineer, sanitary engineering division, at the company's Philadelphia plant.

**Monsanto Chemical Co.**, St. Louis, Mo. reports that the company's plastics division has set up a packaging materials sales department under the direction of R. C. Evans, who will have under him a staff assigned to full-time packaging problems.

**L. Sonneborn Sons, Inc.**, New York, N. Y. will be represented in western Pennsylvania and the panhandle of West Virginia by


# A Crowning Achievement

## FOR POSTWAR CONTAINERS

# HAMMOND MULTI-WALL BAGS

SEWN & PASTED VALVE AND OPEN MOUTH

**CHECK THESE VERY GOOD REASONS:**

✓ 1. HAMMOND MULTI-WALL BAGS are strong. They are built to withstand rough handling in transit and storage.

✓ 2. HAMMOND MULTI-WALL BAGS are *economical*. Providing low cost containers of proven quality.

✓ 3. HAMMOND MULTI-WALL BAGS are *clean* and *sanitary*—a *new* package every time. No "returned bag" nuisance.

✓ 4. HAMMOND MULTI-WALL BAGS are "tailor made" to fit *your* product. Moisture resistant plies may be included when required.

✓ 5. HAMMOND MULTI-WALL BAGS are easy to fill and easy to empty. They keep the product in—the dirt out.

✓ 6. HAMMOND MULTI-WALL BAGS are attractively printed, carrying assurance of the quality of your product to the consumer—*your* customer.

*"ASK THE HAMMOND MAN" . . . FOR MORE GOOD REASONS*

**HAMMOND BAG & PAPER COMPANY**

Paper Mill and Bag Factory . . . . . Wellsburg, W. Va.

Charles R. Munhall who has joined the white oil & petrolatum division of the company. As a sales representative for the division he will have his headquarters in Pittsburgh.

**W. A. Hammond Drierite Co.**, Xenia, Ohio, announces the addition of J. L. Ledeen to its staff as manager of engineering sales. Mr. Ledeen will make his headquarters in Xenia.

**Graver Tank and Mfg. Co., Inc.**, East Chicago, Ind., has named William G. Shipman as plant superintendent. Mr. Shipman is a graduate in mechanical engineering from Cornell University.

**Myler Plastics Corp.**, New York, has opened sales and executive offices at 730 Fifth Ave. The company's new plastics plant is progressing according to schedule and should be ready for production in March.

**Reliance Electric and Engineering Co.**, Cleveland, Ohio, has elected Edward E. Helm, sales vice president.

**Bethlehem Foundry & Machine Co.**, Bethlehem, Pa., has named Nichols Engineering & Research Corp. as sales agents for Bethlehem roasters. This arrangement applies only to multiple hearth roasters.

**Pittsburgh Plate Glass Co.**, Pittsburgh, has appointed William L. Platt as sales representative for the Columbia chemical division. Mr. Platt will be located at the company's office, 300 Babcock St., Boston.

**Sun Oil Co.**, Philadelphia, has appointed Frank R. Markley general sales manager. The appointment of Maximilian H. Leister as general manager of the motor products department also was announced. Ray H. Anders has been appointed manager of the industrial products department.

**Glyco Products Co., Inc.**, Brooklyn, N. Y., has opened new Chicago sales offices at 30 N. Dearborn St., Chicago. This office is under the supervision of Dr. George H. Goodyear.

**Interlake Chemical Corp.**, Cleveland, announces the opening of a sales office in Seattle, Wash. This office is primarily to serve the forest products industries, including plywood, paper and pulp. John J. Bogner will be in charge with headquarters in Smith Tower, Seattle.

**Koppers Co. Inc.**, Pittsburgh, has acquired the entire common stock of Wailes Dove-Hermiston Corp., Westfield, N. J. The company will continue to operate as a separate organization with the same management that has been in charge.

**Project Engineering Co.**, New York, has moved its main engineering design office to 15 Maiden Lane but will continue to maintain operation of its fabricating facilities at Long Island City. The company is under the management of Guy M. Barbolini, Fitch B. Jefferies and James P. O'Donnell.

**Rockwell Mfg. Co.**, Pittsburgh, Pa., has named A. J. Kerr vice president of sales. In his new capacity, he will coordinate the

marketing activities of the various subsidiaries and divisions.

**American Brake Shoe Co.,** New York, N. Y., has appointed Joseph B. Terbell executive vice president of Brake Shoe's American manganese steel division.

**Ertel Engineering Corp.,** Kingston, N. Y., announces the appointment of Lt. S. S. Smith to its New York office as sales engineer in the liquid handling equipment department.

**United States Steel Corp.,** Chicago, has appointed Frank D. Evans, assistant Chicago district purchasing agent for the American Steel & Wire Co., a U. S. Steel subsidiary.

**Iron & Steel Products, Inc.,** Chicago, has named J. R. Lawrence as its representative in the southwest territory. He will have headquarters in the Ritz Bldg., Tulsa, Okla.

**Whittaker, Clark & Daniels, Inc.,** New York, reports that Frank H. Smart has joined the sales staff of that company. He will handle the general line of non-metallic minerals specializing in the plastics field.

**Ideal Commutator Dresser Co.,** Sycamore, Ill., which has been operating under a partnership agreement, has become a corporation under the new name, Ideal Industries, Inc. The new arrangement does not affect management or personnel.

**Foster D. Snell, Inc.,** Brooklyn, N. Y., has named Col. Robert Schmeidler as business manager of that company. He recently returned from 40 months of overseas duty.

**The Bristol Co.,** Waterbury, Conn., announces that George S. Witham has become associated with the company as a consultant on development and sales of their pulp and paper instrument division. J. B Chandler will serve as Mr. Witham's assistant. They will have offices in the headquarters of the company.

**General Electric Co.** Chemical Department, Pittsfield, Mass., has appointed Samuel H. Thomas as New York district sales manager. The district comprises New York, Connecticut and the northern section of New Jersey.

**Westinghouse Electric Corp.,** Pittsburgh, Pa., has promoted L. E. Osborne to the position of senior operating vice president. In his new position Mr. Osborne will be responsible to the president for all manufacturing of the company.

**Timken Roller Bearing Co.,** Canton, Ohio, has promoted Harry McCool. He will be sales engineer for the steel and tube division in the Cincinnati district, which includes Indiana, Kentucky and part of Ohio.

**Hammel-Dahl Co,** Providence, R. I., has appointed Bruce A. Irwin as sales manager of that company. Mr. Irwin, during the war years, was secretary of the PAW Materials Coordinating Committee.

**Johns-Manville Corp.,** New York, has announced the election as vice presidents of

the corporation, of L. M. Cassidy and T. K. Mial. Mr. Cassidy will direct all sales activities of the company. Mr. Mial will undertake a new long-range development program.

**Chicago Bridge & Iron Co.**, Chicago, has reopened its sales office in Detroit, Mich., in the Lafayette Bldg. Edward D. Barrett, formerly of their Chicago office is in charge at the new location

**DeLaval Steam Turbine Co.**, Trenton, N. J., announces the appointment of H. H. (Hal) Barrows, and his organization, the Industrial Equipment Co., as sales representative, throughout the Lower Michigan Peninsula, for the IMO pump and worm gear divisions.

**Tube Turns, Inc., Louisville, Ky.**, has opened an office in Detroit, in charge of Jack Ellsworth. His territory will cover Michigan, northeastern Ohio, northern Illinois, and Indiana, except Whiting and East Chicago.

**Frederick S. Bacon Laboratories**, Watertown, Mass., has been formed as a result of a partnership between Frederick S. Bacon and Philip D. Wilkinson. The new firm will continue the chemical research and consultation business, established in 1939.

**Arthur D. Little, Inc.**, Cambridge, Mass., has been engaged by the Artillery Division of the Ordnance Dept., U. S. Army, to provide research and engineering services in connection with an experimental program for determining the feasibility of large-scale, long-term storage of ordnance equipment. The program will be headed by Dr. Charles S. Keevil.

**American Rolling Mill Co.**, Rustless Iron and Steel division, Baltimore, has named G. D. Moomaw to be general manager of the Rustless Iron division, according to Charles R. Hook, Jr., president of the parent company.

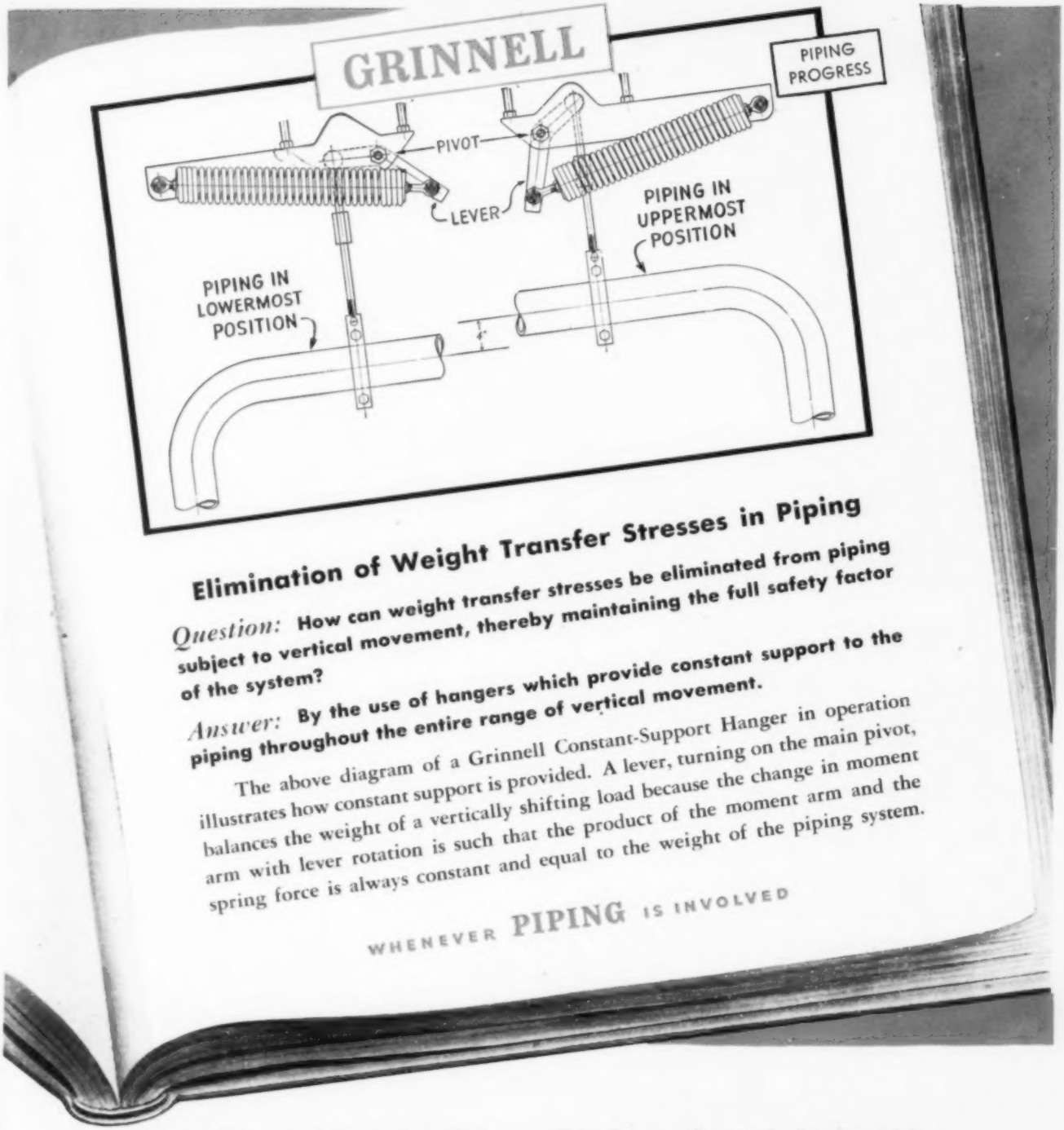
**The American Cyanamid Co.**, New York, announces the appointment of John E. Burdsall as sales representative of their Heller & Merz department in the Miami Valley territory. His headquarters will be at the Heller & Merz Office in Chicago.

**Corning Glass Works**, Corning, N. Y., has announced that Howard E. Bahr is rejoining the company as manager of public relations after four years in the armed services.

**Frank D. Palmer, Inc.**, Chicago, has designated Theron W. Russell as manager of the New York office of the company, according to a statement by Ralph W. Johns, sales manager.

**General Ceramics and Steatite Corp.**, Keasbey, N. J., has named Victor Fisher, vice president of the company, to be general manager.

**The Electric Storage Battery Co.**, Philadelphia, Pa. reports that William Van C. Brandt has resumed his position as manager of the Exide motive power sales or the company after serving in the Navy during the war.




## Elimination of Weight Transfer Stresses in Piping

*Question:* **How can weight transfer stresses be eliminated from piping subject to vertical movement, thereby maintaining the full safety factor of the system?**

*Answer:* **By the use of hangers which provide constant support to the piping throughout the entire range of vertical movement.**

The above diagram of a Grinnell Constant-Support Hanger in operation illustrates how constant support is provided. A lever, turning on the main pivot, balances the weight of a vertically shifting load because the change in moment arm with lever rotation is such that the product of the moment arm and the spring force is always constant and equal to the weight of the piping system.

WHENEVER **PIPING** IS INVOLVED

The designing and production of pipe hangers to meet the varied requirements caused by expansion, contraction, pressure, vibration and load call for a thorough working knowledge of springs, levers and other mechanical devices as well as of pipe and piping systems. As a result of 95 years of piping experience and continuous laboratory research and experimentation, Grinnell is able to offer standard and special-purpose hangers to meet every conceivable requirement in piping.

Whenever piping is involved – Grinnell has the specialized engineering knowledge to handle the job – from first plan to actual operation. Grinnell can supply everything from a tiny tube fitting to a complete power plant installation.

GRINNELL COMPANY, INC. Executive Offices, Providence 1, R. I. Branch warehouses in principal cities. Manufacturing Plants: Providence, R. I.; Cranston, R. I.; Atlanta, Ga.; Warren, Ohio; Columbia, Pa.

**GRINNELL**

WHENEVER **PIPING** IS INVOLVED

# CONVENTION PAPER ABSTRACTS

## CONTENTS



### NON-SILICA GLASSES

ALTHOUGH glass has been one of the miracle materials of our time, most of the new developments up to now have continued to rely on the age-old method of making glass by combining silica with oxides of calcium and sodium. This general type of glass has been the basis for window and container glass manufacture for the past thousand years, but in the light of modern chemistry's discoveries at least three other types—phosphate, borate and fluoride glasses—deserve intensive study. These glasses resemble silicate glasses in general principles of chemical constitution, but differ from them and from one another in important chemical and physical properties.

Fields in which one or more of these glasses may be used include optics, photography, enamels, glasses transparent to ultraviolet light and special colored glasses.

The non-silica glasses have already proved their value in the photographic field. For general use in the field of optical instruments, it is likely that the glasses intermediate between the older silica glasses and the new non-silica glasses will be especially valuable.

Frank L. Jones, Bausch & Lomb Optical Co., before Wabash Valley Section, American Chemical Society, Terre Haute, Jan. 18, 1946.

### TRAINING OF ENGINEERS

WHILE the graduates from engineering schools have somewhat better training in physics, mathematics, and engineering, it has been a general and continual observation that most of the students employed have inadequate training in the fundamental sciences such as physics, physical chemistry, thermodynamics, and any form of mathematics higher than simple calculus. For example, it has been frequently noted that young engineers faced with problems which involve some mathematics generally flounder badly, and that they had little conception of physical chemistry. Another common deficiency lies in the young graduate's lack of knowledge of where to look for the more detailed literature on any subject. An engineer with a sound foundation in basic science can readily adapt himself by means of a few months study of its literature while working in the industry.

One way in which greater cooperation between industry and colleges might be accomplished is through the hiring of undergraduates for summer work. By this arrangement the student would have completed almost one year of his necessary training work and would certainly get much more from the courses he would be taking in college.

During the War, the Army and Navy used aptitude tests for selecting men for a multitude of purposes and claim great success with these procedures. Quite probably the colleges could also use them as a guide to the kind of course which a student should take and also as to the kind of work which a graduate should follow upon leaving college.

Many companies have announced plans for new or enlarged research facilities and the amount of money appropriated for this work in industry will be greatly increased. More technical men will be needed for fundamental research; more trained engineers for controlling operations and introducing new products for manufacture; and more sales engineers for sales and service work among consumers. A serious deficiency now exists and cooperation between colleges and industry should save at least two years in the training period.

E. C. Wright, National Tube Co., before American Institute of Mining and Metallurgical Engineers, Chicago, Feb. 25, 1946.

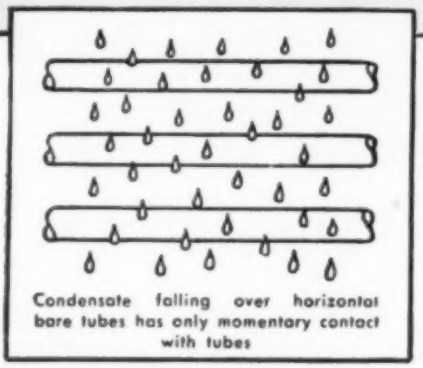
### RAYON AND RUBBER

THE Industrial Rayon Co. of Cleveland and Painesville, perhaps the largest employer in the chemical industries of the Cleveland area, provides a prime example of the integration characteristic of the chemical field. Just before the war, viscose rayon production had reached 285 million pounds a year. Engineers of Industrial Rayon and Goodyear in Akron had developed a rayon cord which made possible a thinner and stronger tire, one generating less heat. Soon after the outbreak of war the War Production Board worked up a program of 290 million pounds of rayon for tire cord alone. This never had to be achieved in complete form. To a small extent from conversion and to a much greater extent from new construction, 240 million pounds capacity were provided for tire cord. As a result the total capacity of the industry is now about 490 million pounds.

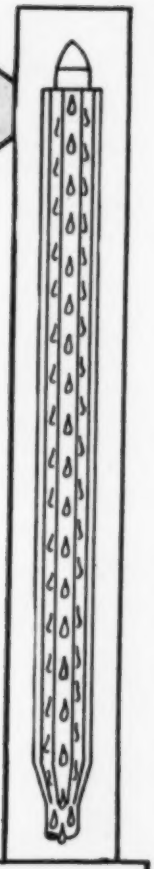
The truck tire of average size now uses 10 lb. of rayon cord and the passenger tire of average size 2.4 lb., but 0.65 lb. of rayon replace 1 lb. of cotton, making the rayon cord cheaper than cotton at current prices of the two. Furthermore, each pound of rayon saves about half a pound of rubber. So it is not extravagant to say that rayon cord will replace cotton within the next several years. A similar development is now going on in the use of rayon cord in V-belting. Its function there is parallel to that in the tire.

Because of the proximity of the tire plants and the distance of the weaving industry, Industrial Rayon built up its own fabric weaving capacity at its plants here, with a saving of considerable freight and bother in shipping reels to the weaving plants in the

# WHY THE G-R G-FIN CONDENSER GIVES UNEQUALLED SUB-COOLING . . .



Condensate falling over horizontal bare tubes has only momentary contact with tubes



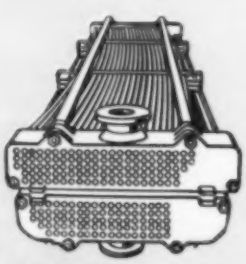
Condensate falling over vertical G-Fin tubes in constant contact with entire length of pipe

## ONLY G-R BUILDS THIS WIDE VARIETY OF HEAT TRANSFER APPARATUS

**SHELL and BARE TUBE**
Heaters, Coolers, Condensers, Heat Exchangers

**G-FIN**
Longitudinal-finned elements for greater heat conductivity

**K-FIN**
Helical-finned elements for vapors and gases



**BENTUBE EVAPORATOR**
Scale-shedding Elements

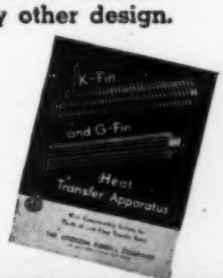
**TUBEFLO SECTIONS**
Non-clogging design for residuum and other dirty fluids

In conventional types of horizontal bare-tube condensers, the condensate, in dropping down over the tubes, is in contact with each tube for only a brief period. As a result, the condensate receives little sub-cooling effect, and some may even be re-vaporized.

Compare with the G-R G-Fin Condenser. Here, the condensate which forms on the longitudinal fins is guided downward as it hugs the tube surface throughout the entire length of fins and tube—sometimes 20 feet or more in length.

This explains why the G-R G-Fin Vertical Condenser is so far superior to multiple shell horizontal bare tube condensers, and is one of the many reasons why this unit provides better condensing and sub-cooling results at lower cost than any other design.

Write for Bulletin 1625 explaining in detail the exclusive advantages of this unit and the other G-R finned-tube apparatus available for practically every heat transfer service.




**THE GRISCOM-RUSSELL CO.**
285 Madison Ave. New York 17, N. Y.

# GRISCOM-RUSSELL

*Pioneers in Heat Transfer Apparatus*

south and back again. This new textile department is not a portion of the chemical industry but it shows again how, in that field, one thing always leads to another.

Furthermore, the presence of this large segment of the rayon industry here has increased the market for sulphuric acid, chlorine and caustic soda, all of them obtained in the district. As for Akron, which perhaps should be considered a part of the Cleveland district—or even the other way around, if the future of rubber is in the synthetics—Goodyear is to build a pilot plant at Akron to make rayon cord, and there is Firestone with its vinyon. Might it not be possible that an Akron interest would expand into synthetic fibers, their manufacture and fabrication, in such a way as further to strengthen the bonds between the two cities? Incidentally two or three Canadian makers of pulp are further processing their material for the rayon industry, and they are convenient of access to this district.

John W. Love, The Cleveland Press, before Chemical Market Research Association, Cleveland, Dec. 13, 1945.

## CHEMICAL UTILIZATION OF WOOD

It is hardly necessary to point out the huge amount of wood that is wasted each year in the United States. It will take more than the chemist to solve the problem adequately. Even if the chemist had all the chemical facts regarding a potential utilization process, there is still the necessity of determining its economic and mechanical feasibility. Economical harvesting and transporting of wood waste so that it can be delivered cheaply for chemical use seems to be the biggest obstacle confronting the chemical utilization of wood. This phase of the over-all problem is the one in which foresters and engineers can make their biggest contribution. Those who are anxious to contribute to the solution of the waste-utilization problem can well focus attention on harvesting and transportation of woods waste in small log, cordwood, chip, or sawdust form.

The chemical utilization of wood may be divided into several types of processes: (1) Pulping, (2) extraction, (3) hydrolysis (converting carbohydrates to sugars), (4) destructive distillation, (5) reactions with various chemicals such as hydrogen and chlorine, and (6) chemical treatments to improve the properties of wood and make possible the utilization of inferior species for structural use.

Although a great deal has been accomplished in developing means of chemically utilizing wood and in making modified woods, no universally successful process of utilizing the vast amount of inferior or waste wood has been developed. Individual operators, however, may be successful in using any of the processes. Their success will largely depend upon making careful surveys of the source of wood supply, markets, and economical size of the prospective plant before venturing into any extensive operations.

Although the modified-wood field is primarily based on using high-quality wood chiefly in the form of veneer, there is the possibility of some manufacture based on the use of short dimension stock that is classed as waste because of size rather than quality. Compreg knife and other handles, knobs, and various decorative novelties can

all be made to advantage from short lengths of solid wood rather than from veneer. The increased value of the product would make possible a more scrupulous selection of wood than would be possible for similar products made from untreated wood.

Further research on chemical utilization and modification of wood will undoubtedly expand the present possibilities of waste utilization, but the chemist needs the help of the forester in working out the problem of delivering the waste cheaply in large quantities to the processing plants.

A. J. Stamm, Forest Products Laboratory, before Southeastern Section, Society of American Foresters, Auburn, Ala., Oct. 26, 1945.

## FERTILIZER LEGISLATION CONDEMNED

Despite all the recognized handicaps of wartime construction the war record shows that large, small, medium, corporate, cooperative and new as well as old factors in the fertilizer industry jumped into the breach and with the headaches which those directly involved know best, built, equipped and finally put in operation a number of new plants and plant additions.

Obviously, phosphates were among the important requirements. Even with a large portion of our high analysis phosphate production soundly assigned for export to our Allies under lend-lease, and acid supplies for phosphate processing limited by war demands, industry performed the miracle of exceeding all previous records during each of the war years.

Just as many of us would have liked more beef, pork and bacon while the farmers of the nation were piling up new production records, so also did some fertilizer demand go unsatisfied while we attained new heights of production. Such is the basis for the uninformed or the prejudiced to clamor for a government crutch with which to "save the fertility resources" of the nation. The other justification of such forces seems to be that because during the war, tax funds were tapped heavily to finance plants for war needs, the nation's taxpayers should be able to "spare a few millions a year to save our national soil fertility" through government production of fertilizers.

Such an uncourageous approach to an important problem would give many of us a laugh if we did not recognize the ugly implications it has in a complex civilization of which we are a part. Certainly private enterprise is imperfect, just as our modern democracies fall short of ideals. But the healthy effects of competitive enterprise outweigh the theoretical advantages of a paternalistic state.

Maurice H. Lockwood, before National Fertilizer Association, Atlanta, Ga., Nov. 13, 1945.

## AGRICULTURAL ENGINEERING

Engineering planning can help agriculture solve problems of surplus crops and assure a steady supply of farm raw materials for factories. Today the farmer, or the specialized agriculturalist, needs the help and cooperation of the engineer to effect a change of agricultural planning—for the farmer to do his own planning and to apply the engineer's scientific method of planning to an agricultural planning for permanency instead of for emergency. Cotton, beets,

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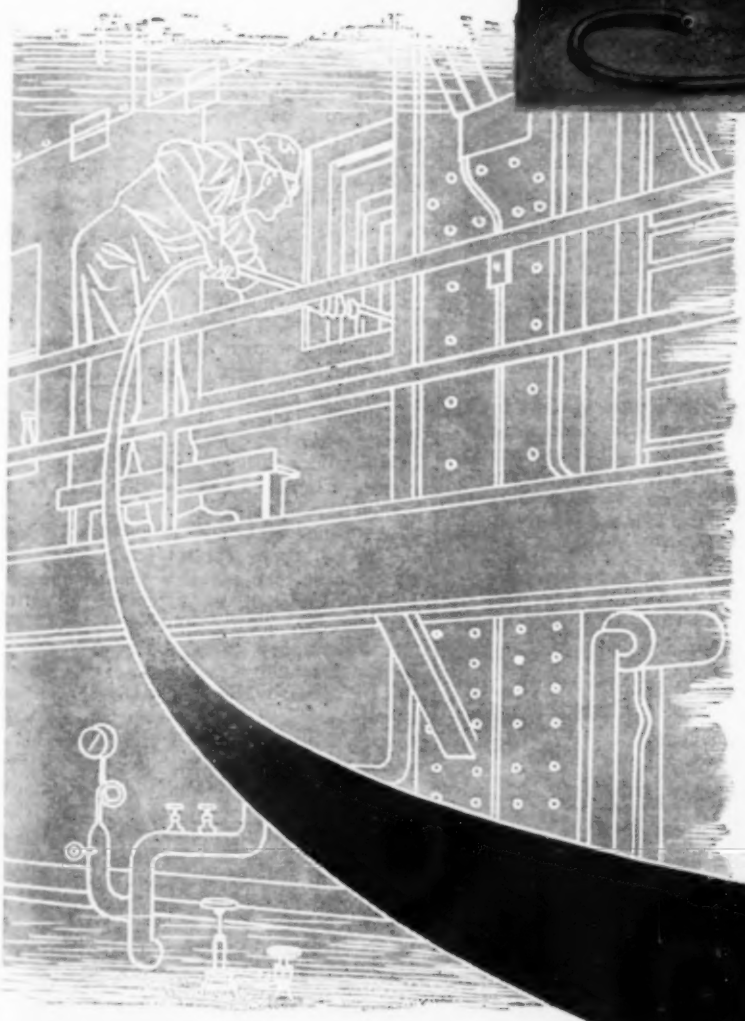

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corn, wheat, milk, hides, forest wastes and potatoes are only a few of the farm raw materials now used widely in industry, making the agriculturalist already associated with chemical engineering.

In industry, engineering planning must indicate how much profit can be made, how much can be paid for labor, for further development, for taxes, for overhead, for sales, and for distribution on a continued and permanent basis. Engineering planning demands an assured, uniform and low priced supply of raw materials.

The agricultural planning likewise should include the same assurance of uniform, steady, and low priced raw materials if the raw materials from the farms are to continue to find use in the industries. Industries cannot operate on surpluses occurring periodically.

Engineering is the application of science to things people want, either fabricated or processed. Our cotton, corn, potatoes and rice cannot depend solely upon fabrication, but also depend upon processing. It appears that the cooperation of the engineer in the councils and in the laboratories to seek the answers to the agricultural problems will aid in agricultural planning.

With agricultural planning for permanency, another political attempt by a few agriculturalist states to impose a general tax on other states to assist them in disposing of their periodic surplus will be more quickly recognized as a selfish sectional effort detrimental to the entire nation as well as as other sections.

Limited or discipline action through statistical information will readily point out that the helping hand will be extended only to those who are deserving of it, or who are unfortunate by circumstances, and not by repeated willful action. We hope Iowa and Illinois will not attempt to hamstring Texas and Oklahoma, nor vice versa.

Utilization of farm wastes for synthetic lumber manufacture can be proved to be a feasible, sensible method of elimination of a waste, not needed in certain areas. But the pressuring by control groups to keep the price up to the level of natural finished lumber is unfair to the public as well as to the synthetic lumber industry.

An attempt to pressure the use of lard to the exclusion of processed cottonseed oils by several pork-raising states shows the extent to which selfish pressure groups will extend. Cottonseed oil is as much a farm commodity as lard. If cottonseed oil is a by-product of textile cotton, so is lard a by-product of pork.

And the wealth created by processing, the industries functioning in the processing and the laborers employed in the processing of cottonseed oil are as important to the country as a whole, and more important to the South, than the same variants applied to lard.

Frank C. Vilbrandt, Virginia Polytechnic Institute, before Wilson Dam Section, American Chemical Society, Florence, Ala., Nov. 21, 1945.

## A PETROLEUM POLICY IS NEEDED

It is unlikely that anyone would seriously suggest that we have a national oil policy now. Of course, in any consideration of what a national policy should be, we begin with the question: What do we want to



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accomplish? Well, so far as oil is concerned, we all can agree that there are at least two ends that we wish to gain: First, we want to assure ourselves of ample supplies for so far in the future as that may be possible. Second, thinking in broad terms as war has taught us to do, we want the world's oil to be utilized to further the well-being and security of all peace-loving nations. Thus we may hope to reduce the danger of another world war.

I do not think that we are about to run out of oil. But nobody can tell us, for certain, how long we will be able to supply our domestic requirements from our own sources. It may be for years and it may be forever. But I don't know, and you don't know, and nobody else knows. Therefore, I come back to what I consider to be a safe and sane, a positive and creative course for us in these United States:

Let us do all that we can to stimulate the exploration for oil in the United States.

Let us use efficiently the oil that we have so that it may last so long as possible. Most of all let us eliminate waste.

Let us assure ourselves of access to foreign oil resources so that they may supplement our domestic supplies when, or if, they are needed.

It is my belief that, both domestically and abroad, the oil job should be done, just so far as possible, by private industry. The initiative, the resourcefulness, the vigor and the competitive zest of private industry have developed our oil resources with an efficiency unmatched anywhere else in the world. In his activities abroad, the American oil man has operated in a manner which, with few exceptions, has promoted the interests, not only of the United States, but of the countries where he has operated. Therefore, I would consider it unwise and unfortunate for government to interpose itself in any phase of the oil business which can be handled by the industry efficiently and economically and with the satisfaction that a fair profit brings.

Harold L. Ickes, Secretary of the Interior and Petroleum Administrator for War, before American Petroleum Institute, Chicago Nov. 14, 1945.

## SPRAY DRYING OF MAGNESIUM CHLORIDE

At Lake Charles, dolomite was calcined to produce a mixture of CaO and MgO. This was ground, hydrated and mixed up into a slurry with calcium chloride solution pumped in from the adjacent alkali plant. This calcium chloride solution contained both $CaCl_2$ and NaCl. The slurry was then carbonated with the $CO_2$ recovered from the calciners to produce a supension of $CaCO_3$ in $MgCl_2$-NaCl solution. This was filtered and evaporated. Sulphate was precipitated by the addition of barium chloride before filtration.

The filtrate was evaporated to a concentration suitable for spray dryer feed. The solubility of NaCl becomes very low as the $MgCl_2$ is concentrated. The precipitated salt was removed in salt settlers and the concentrated $MgCl_2$ solution pumped to glass-lined storage tanks which in turn supplied with spray dryers.

Spray drying was chosen in order to dry the $MgCl_2$ fast enough to prevent excessive hydrolysis. Inlet temperature of 950 deg. F. and outlet temperature of 400-420 deg. F.,

with an atomizer speed of approximately 12,000 r.p.m. and holding time of 6 sec. in the drying chamber produced a product containing 18-20 percent $H_2O$, 1.5-2 percent MgO, and 78-80 percent $MgCl_2$. This consisted mainly of fine jagged particles, which were readily compacted to produce dense, hard grains for the electrolytic cell feed.

Inconel was found to be the most suitable structural material for the atomizers. In actual production at Lake Charles a five-piece forged and machined atomizer with replaceable vanes had a life in excess of 3,000 hr., without replacing the vanes. Spray chambers of steel were satisfactory. Close temperature control was essential to uniform quality and operation. Blocking of the atomizer by suspended and dissolved NaCl was overcome by flushing every half hour with hot water.

The spray dried $MgCl_2$ hydrate was conveyed to storage bins which supplied the briquetting process, which discharged through grinders and screens to provide the proper size feed for the cells.

In the cells the $MgCl_2$ hydrate was fused and electrolyzed. The remaining water was driven off at the instant the feed melted and was withdrawn separately from the $Cl_2$ stream. Some of the water reacted to form additional MgO which with that already present in the feed settled to the bottom of the cell.

K. E. Kunkel, Mathieson Alkali Works, before the American Institute of Chemical Engineers, Chicago, Dec. 18, 1945.

## DUST CONCENTRATION AND CYCLONE VOLUME CAPACITY

When a cyclone test is in operation with a volume of air passing through the cyclone regulated to give a predetermined pressure drop across the cyclone the addition of a test dust to the air stream decreases the pressure drop. That is, a given volume of air with dust in suspension will pass through a cyclone with less apparent resistance than the same volume of air without the dust, or a greater volume of air will pass through a cyclone at a given pressure drop with dust in suspension than will pass without dust at the same pressure drop.

A formula may be used for the calculation of the air flow through the cyclone from the pressure drop across the unit. This is:

$$Q = K(H_o T\ PD)^{\frac{1}{2}}$$

where $Q$ is volume of clean air flowing, cu. ft. per min.; $K$ is volume constant of the unit; $H_o$ is pressure drop across the cyclone, clean air flowing, in. water; $T$ is temperature, deg. F. abs.; $P$ is absolute pressure, atm.; and $D$ is specific gravity of gas referred to dry air.

Experimentally obtained data were plotted. They yielded a straight line which may be represented by the equation:

$$(H_o - H)\ H = 0.01335\ C^{\frac{1}{2}}$$

where $H$ is pressure drop across cyclone when dust is fed to cyclone, in. water; and $C$ is dust concentration, grains per cu. ft.

When determining cyclone performance in an operating plant it is seldom possible or practical to measure the pressure drop across the unit with clean gas for comparison with the pressure drop obtained with an equal volume of the same gas containing dust in dispersion. With a plant in operation, the gas contains dust and the volume of gas passing through the cyclone must be

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$C_6H_5CF_3$

| | |
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| Molecular Weight | 146.1 |
| Freezing Range | −28.5° to −29.5°C |
| Boiling Range (ASTM, 98%) | 2.5° including 101°C |
| Refractive Index, n20/D | 1.4145±.0005 |
| Specific Gravity, 15.5°/15.5°C | 1.197±.001 |

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| PRODUCT<br>*Chemical Formula*<br>*Molecular Weight* | DESCRIPTION & USES |
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| **Ammonium Benzoate, Tech.**<br>$C_6H_5COONH_4$; 139.1 | White crystalline solid. Preservative for latex and adhesives; manufacture medicinals. |
| **Benzoate of Soda, U.S.P., Tech.**<br>$C_6H_5COONa$; 144.0 | White, odorless crystalline solid. Purity 99% min. Preservative for tomatoes, catsup, margarine, fruit juices, pharmaceuticals, tooth paste and powder; curing tobacco. |
| **Benzoic Acid, U.S.P., Tech.**<br>$C_6H_5COOH$ 122.1 | White odorless, crystalline solid. Purity 99.3% min. Manufacture of dyestuffs, perfumes and pharmaceuticals, ingredient of cosmetics, pharmaceutical preparations, antiseptics, dentifrices; preservation of food; curing of tobacco. |

| PRODUCT<br>*Chemical Formula*<br>*Molecular Weight* | DESCRIPTION & USES |
|---|---|
| **Metanitrobenzoyl Chloride**<br>$NO_2C_6H_4COCl$; 185.5 | Yellow to brown liquid, partially crystallized. L. C. P. 28° to 31°C. Manufacture dyes for fabrics; color photography; pharmaceuticals. |
| **Methyl Benzoate**<br>$C_6H_5COOCH_3$; 136.1 | Clear, colorless liquid. Sp. Gr. 1.0930. B. R. 2° including 199°C. Ingredient of perfumes, soaps and medicines; preservative for rubber. |
| **Paranitrobenzoyl Chloride**<br>$NO_2C_6H_4COCl$ | Yellow crystalline material in lump form. Decomposes in water and alcohol; soluble in ether; M. P. 70°C min; purity 93% min. Manufacture of Novocaine and dyes. |

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determined under those conditions. In such cases, therefore, it is necessary first to determine the dust concentration per cubic foot of gas entering the cyclone by known sampling methods. The pressure drop across the cyclone, when the unit is handling gas with dust in suspension, is readily measured. By means of the second equation given above the value of $H_o$ can be calculated; and from the first equation the true volume of gas flowing through the unit can be calculated. Since $H_o$ is a hypothetical pressure drop for clean gas, $D$ is also the specific gravity of the same dust-free gas.

Donald W. Briggs, Western Precipitation Corp., before the American Institute of Chemical Engineers, Chicago, Dec. 17, 1945.

### ENCOURAGING CHEMICAL INDUSTRY IN THE SOUTH

During the next few decades science will play a more important role in industry than ever before. We must learn our lesson from the large industries founded on research and make the most of our opportunities. The tendency toward decentralization favors the small southern city but industries requiring technical skill cannot be attracted to a region that is technically poor. We should make an effort to retain the machinery and skilled labor used in our war plants and use these resources for the creation of new industry. Southern industry should not be handicapped by unjust railroad rates, unsuitable climatic conditions, or lack of skilled labor. Definite improvement has been made in the equalization of railroad rates. Because of advancements in air conditioning, the South can provide any condition of temperature and humidity that may be required by any industry.

Our job is to encourage new and to aid present industry. Therefore, we shall try to be of maximum service. No job will be considered too small, provided it can be solved through scientific research. Of course, we have accepted large projects but we believe small projects are essential and that successful solution of these will increase technical, non-technical employment.

We have started our program of education and research in the South, but the job to be done is tremendous. There is an immense frontier to be attacked. We plan to do our part and intend to cooperate with all those who are concerned and to prove that "Everything that was ever possible for mankind is possible here."

R. B. Seymour, Industrial Research Institute, before Baton Rouge Regional Meeting, American Chemical Society, Oct. 26, 1945.

### FUTURE CHEMICAL NEEDS OF THE PROTECTIVE COATING INDUSTRY

Those engaged in the protective coating industry would consider their chemical needs well satisfied were they able to acquire really adequate supplies of good old fashioned linseed oil and rosin. However, it would probably be more interesting to consider the chemical needs of this industry in what is hoped will be the not too distant future when we are no longer burdened with a fat starved world and the stockpile of naval stores no longer resembles the nylon counter of a department store.

Binders are usually soluble in or miscible with liquid aliphatic hydrocarbons. Accordingly, in most cases, ordinary petroleum

naphthas are suitable for use as thinners, a high solvent power being, in general, unnecessary. There is great need in the industry for a really odorless thinner or at least a thinner with an odor generally recognized as pleasant.

Practically without exception highly efficient solvents have two disadvantages. In the first place they are relatively expensive organic chemicals such as alcohols, ketones, esters and the like. Second, they possess an overpowering and, to most individuals, a very unpleasant odor. The lacquer industry would get a very valuable boon were a relatively inexpensive, odorless yet powerful solvent developed for the non-convertible binders employed.

There is considerable room for improvement in opaque white pigments. Obviously, there is always the possibility of developing a material of even higher refractive index than exhibited by presently known materials which possesses at the same time generally satisfactory pigment properties. The highest hiding value white pigments are inert and hence are rather difficult to grind or disperse in the binders employed. A pigment that is reactive with the binder is usually easy to disperse in the binder and accordingly grinds fast and develops its full opacity rapidly. There is much room for improvement in the grindability of present day high hiding pigments.

Considerable advance has been made in tinting pigments and further advances are to be expected in improving the grindability or dispersibility of tinting pigments through various surface treating techniques.

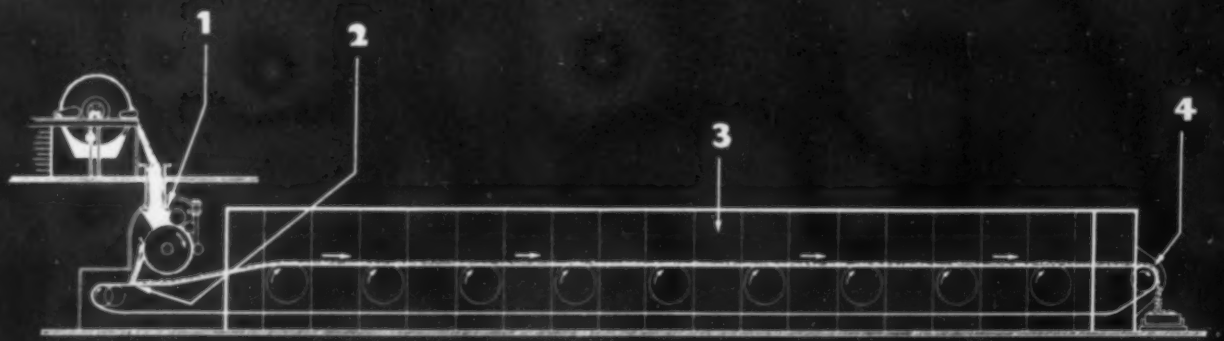
Extenders have long been the neglected black sheep of the pigment group. A satisfactory surface coating film for a given set of conditions should have, among other things, at least a minimum hiding value and a proper pigment volume concentration. If a high hiding power pigment is employed, the minimum required hiding value is usually reached long before the necessary pigment volume concentration is achieved. Extenders represent a fertile field for future research and improvement. For utmost adaptibility they should be of good color although colored extenders can be employed in tints and darker formulations. For many purposes soluble salts should be absent. The oil absorption should not be too high so that the consistency characteristics of the final formulation will be satisfactory.

The desirable features of a more nearly perfect non-convertible binder may be deduced from a consideration of the good and bad features of materials now used. Such a future non-convertible binder should be flame retarding, moisture resisting, soluble in inexpensive solvents or solvent mixtures and compatible with a wide list of convertible binders. Cellulose esters of such dibasic acids as maleic and succinic, either simple esters or mixed esters containing the acetate radical may find many new uses.

Undoubtedly, the most important and widely used synthetic resins of the surface coating industry are the alkyds. As can well be imagined, an enormous amount of work has been done on these classical alkyds and while the possibilities of their improvement through modification with third components, have not been exhausted by any means, it is evident that the development of each inexpensive polycarboxylic acid and

# PROCTOR *Aero-Form* DRYER

## with Fin Drum Feed—Speeds Output of CALCIUM CARBONATE



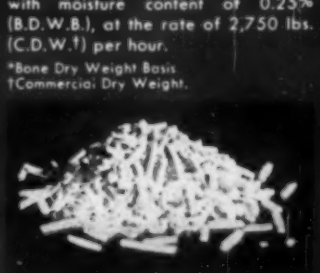

**1.** Calcium carbonate is delivered from continuous filter to hopper of fin drum feed of dryer with moisture content of approximately 110% (B.D.W.B.*).

**2.** Partially dried on fin drum feed, material is pre-formed, into small sticks of uniform size and thickness and discharged to conveyor of dryer.

**3.** Loaded to a uniform depth on moving conveyor, material passes through 9-unit dryer. Temperatures begin at 270°F. in first compartment, increase to 280°F. in second compartment and to 290°F. in third compartment.

**4.** Calcium carbonate, uniformly dried, is discharged from dryer with moisture content of 0.25% (B.D.W.B.), at the rate of 2,750 lbs. (C.D.W.†) per hour.

*Bone Dry Weight Basis.
†Commercial Dry Weight.



Close-up of "fin drum sticks" shows form in which material enters dryer . . . allowing through-circulation.

## ONE OF MANY TYPICAL APPLICATIONS FOR THIS MODERN CONTINUOUS DRYING SYSTEM

This application is but one of many, where this system is used for the continuous drying of wet-solids. In each case, the material comes to the feed hopper after mechanical dewatering. It is then pressed, by means of rollers, into the grooved surface of the internally heated, revolving fin drum which forms the feeding device. In this way, the material is dried sufficiently to be discharged, from the drum, to the conveyor of the dryer in the form of small sticks—of uniform thickness. It is then possible to circulate heated air *through* the bed of material on the conveyor and rapid, uniform, thorough drying results. This particular pre-forming and drying system may or may not be suited to the physical characteristics of your product. However, it demonstrates what we mean when we say Proctor drying systems are scientifically engineered to meet individual plant and product requirements. This system—in fact every Proctor system in operation—was installed only after it was conclusively proven in the laboratory that it was the ideal system for the individual problem. Proctor engineers may well save you hours of production time and reduce your costs materially—if you let them consider your drying problem today!

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each inexpensive polyhydric alcohol serves to add a new string to the resin maker's lute. By changing one or more of the classical alkyd reactants it may be possible to produce satisfactory resins which at a given concentration and temperature show a lower solution viscosity than classical alkyds. The high solids solution is capable of depositing a thicker film in a single coat so that an adequate film is obtained with one coat or at least with fewer coats than previously required. It is believed that this and many other "plus factors" represent the principal rewards of future developments.

A satisfactory drying oil possessing a refractive index lower than those exhibited by present drying oils very probably would be just as efficient in increasing hiding power as some as yet undiscovered super pigment. There are hints that such drying oils are feasible. It is believed that if as much effort were to be expended on this drying oil approach as has been expended on the development of pigment titanium dioxide the results would be just as revolutionary.

R. F. Ruthruff, The Sherwin-Williams Co., before the Chemical Market Research Association, Cleveland, Dec. 13, 1945.

## INSECTICIDES AND INSECTS

GLOBAL warfare has ended, but the war with injurious insects continues. This conflict has been going on since the dawn of man's history and will probably continue until its close. Not only do insect pests destroy our crops, but they harbor and transmit some of the most serious diseases of men and animals. Unless we stop killing one another in ever-increasing numbers, at the rate we are going we will kill ourselves off and insects will be our inheritors.

Despite great advances in insect-destroying techniques 20 percent of America's annual cotton output has been ruined in the last decade by six of the more common insects attacking this crop.

Likewise, four of the more common insects attacking corn have reduced the average per acre yield of this crop by 13 percent. Much the same situation exists with respect to vegetables and fruit crops. Crop pests have not caused more serious and frequent economic disturbances only because allowance is made for them in arriving at acreage requirements.

In war as well as in peace, insects interfere constantly with the plans of men. Mosquitoes, which transmit malaria and yellow fever, and the body louse, which carries typhus fever, have even determined the outcome of major military operations.

Not all insects are harmful, however. In fact, of the 600,000 species known today only about 6,000, or 1 percent, are considered dangerous and of these only about 70 kinds are responsible for most of the agricultural losses in this country. Insects are agents of pollination of many flowers and hence are responsible for the growth of many fruits and vegetables. Some insects kill others which are harmful; and some form an important source of chemicals such as beeswax, cochineal, silk and shellac. In view of these facts, man must learn to live with insects in general while attempting to control or eradicate those dangerous to his food economy and health.

Lead and arsenic compounds are the

major agricultural insecticides and copper, sulphur and mercury compounds as the chief weapons for guarding crops against fungi. The wartime development, DDT, will find considerable use in both agricultural and household insecticides.

Insecticides derived from arsenic, lead and fluorine are the major sources of supply for the industry. In 1944 more than 150,000,000 lb. of arsenic-containing insecticides and about 18,000,000 lb. of fluorine-containing insecticides were employed.

Because these elements are also toxic to man and animals, health authorities have expressed concern over the spray or dust residue on fruits and vegetables to which they have been applied. In addition, it has been shown that codling moth larvae, which do enormous damage to apples, are developing strains highly resistant to lead arsenate.

Since the use of other inorganic compounds would also leave residues that might be health hazards, the trend in the development of new insecticides has been directed towards utilization of organic compounds. Organic insecticides may be divided into three broad classes—those of animal origin, those of plant origin and those prepared synthetically. The first class consists of fish oils, glue and petroleum oils, the petroleum oils being most important. Of several hundred plants tested for insecticidal properties, only a few have shown enough promise to be of commercial value, the most important being tobacco, pyrethrum, and the rotenone-bearing plants, derris and lonchocarpus. Tobacco owes its insecticidal properties primarily to nicotine and nornicotine.

H. L. Haller, U. S. Bureau of Entomology and Plant Quarantine, New York Section, American Chemical Society, New York, February, 1946.

## IDENTIFICATION OF SYNTHETIC RESINS IN PAPER

A FEW years ago it was only necessary to be able to determine if a paper contained rosin, starch, glue, or casein. However, during the last few years, synthetic resins, which were developed primarily for use as plastics, have been applied to papers in one form or an other and, because of the increasing use of these materials, the question of the possible qualitative identification of these resins becomes important.

In most instances, papers are not, as a rule, sized with any of the new resins alone but in different combinations with other sizing materials, such as rosin, alum, starch, and glue, together with any one of the numerous plasticizers. Also, some fillers and dyes added to the papers may have some influence, whereby the problem of qualitative determination of the presence of each of these materials becomes complicated.

However, before a quantitative determination of any of these different sizing materials can be made, it is important that a relatively quick, simple, and dependable method be developed. Because combinations of any of the different synthetic resins, rosin, alum, starch, and glue may be present in different and varied amounts in a paper, it is clear that dependable results cannot be obtained with a single stain or reagent, but that two, three, or more different tests may be necessary for the proper identification of the different sizing materials present.

The sizing and resin materials used in a paper can be satisfactorily determined by

first applying the Raspail test, then the iodine test, then any one of the selective dyeing reagents (Texchrome has been selected), and then finally checked by determining by which method the paper most easily disintegrates.

The Raspail test splits the papers into three distinct groups; the iodine test splits those into seven other groups, which again, by Texchrome stain are split into 16 groups and these are split in some instances by the method by which they disintegrate.

Applying these methods to the papers tested, the results show that the papers have been qualitatively separated into the following distinct groups: Waterleaf sheet; polyvinyl copolymer; polyvinyl chloride-acetate and cellulose acetate butyrals; chlorinated rubber; polyvinyl acetate; polyvinyl butyrals; ethyl-cellulose; starch and alum; phenol-formaldehyde; urea-formaldehyde; rosin, alum, starch, and glue; melamine; and rosin, alum, and starch.

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John H. Graff, The Institute of Paper Chemistry, before Kalamazoo Valley Section, Technical Association of the Pulp and Paper Industry, Kalamazoo, Oct. 4, 1945.

### TRENDS IN COAL RESEARCH

At the present time the coal chemical industry can help to strengthen its position by aggressive and organized research along the following lines: (1) Development of new or improved methods for recovery of individual products from the tar at lower costs and more efficiently; (2) increase in the qualities of existing tar products; (3) development of uses for the tar compounds or fractions, either new and broader applications for the products themselves, or synthesis from them of derivatives which can find application in industry.

Among the many problems which the tar offers, recovery of naphthalene is particularly important at this time. It is usually recovered from the tar distillate by a crystallization process, and the crude product refined by distillation, hot pressing, acid washing, or some combination of such treatments. Several grades are produced, each crystallizing in a different temperature range. The tendency of all products is to increase the purity or quality. The impurities in a chemical represent material which is not only useless to the purchaser, but often proves injurious by causing undesirable side reactions, thus interfering with a process. In the case of naphthalene little is known about the impurities which are present. Each plant has developed a procedure which meets its needs. It appears, however, that some fundamental work on the recovery of naphthalene would be helpful in increasing yields and quality and in lowering costs.

Closely related to naphthalene and occuring in tar fractions with it are methylnaphthalenes. A number of uses have been found for some of these homologs. They have been used to produce phthalic anhydride and in syntheses of chemicals affecting the growth of plants, for instance, but the volume of production does not appear to be large. An investigation of the recovery and utilization of the methylnaphthalenes seems a logical sequence to the recovery of naphthalene.

Interest in higher phenols and phenol homologs is active. One petroleum refiner

has recently devised a method for separating the isomeric cresols by first converting them to butyl phenols. The latter are then separated by distillation, and finally changed back to the original but pure cresols. This sort of thing the coal chemical industries could well be doing for themselves.

In the work on tar chemicals attention should be given to the new refining and reforming processes which have come to the front so rapidly during the war. Extractive and azeotropic distillation, hydrogenation, oxidation, reforming, and other methods should prove useful tools.

The remaining 80 percent of the tar is marketed in the form of more or less crude mixtures, the latter can be rendered more uniform in quality or modified to suit specific demands. There is always room for work in the fields of coal tar oils, creosote, and pitch to increase the values and extend the applications of these fractions.

In the case of the light oil, the most important problems are the utilization of the benzol, toluol, and xylol. There is a steady trend towards higher quality in the benzol homologs.

There are further possibilities for separating pure compounds from the light oil. A good process for separating the isomeric xylols would tend to increase their range of usefulness. Cyclopentadiene is now being recovered from the forerunnings, and the demand for this chemical should increase due to its many versatile uses. Competition from petroleum cyclopentadiene is to be anticipated, but the coke plants start with a fairly concentrated material in the forerunnings, and should continue to recover and dispose of this small fraction of their light oil. Olefins and carbon bisulphide are also present in the forerunnings, but little has been done on their recovery.

One of the big problems facing the coke plant operator is what to do with his ammonia. Prior to the war the synthetic nitrogen utilized by the fertilizer industry went mainly into the ammoniation of superphosphate, and the production of ammonium sulphate and sodium nitrate.

In the face of competition what is the coke oven operator to do? The only recourse appears to be to study recovery methods, both existing and proposed, as critically as possible in an effort to improve the costs. Recovery of the ammonia in a form which can be converted to different products, such as ammoninm sulphate or ammonia liquors, to suit market demands may help the situation somewhat.

After coke oven gas has been debenzolized, the gas contains small amounts of hydrogen cyanide, organic sulphur compounds, principally carbon bisulphide, pyridine bases; naphthalene; nitric oxide and resin-forming compounds, traces of amonia and water vapor. Of these compounds the hydrogen sulphide, hydrogen cyanide, and naphthalene have value when recovered in a suitable concentrated form. Interest in removal of sulphur from coke oven gas for industrial use is increasing. Hydrogen cyanide contributes to corrosion and due to the value and the good market for cyanides, interest in methods for their recovery is increasing.

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P. J. Wilson, Jr., Mellon Institute of Industrial Research, before Blast Furnace and Coke Association of the Chicago District, Chicago, Feb. 5, 1946.

# FOREIGN LITERATURE ABSTRACTS

## DIFFUSION LAYERS OF CHROMIUM FOR PROTECTION OF IRON

PROTECTION of iron and steel objects by application of diffusion layers of aluminum, chromium and other metals is widely used in industry. The diffusion layers, obtained at a high temperature, are dense and practically non-porous with high protective and mechanical properties. The thickness of the diffusion chromium layer formed on the surface of the iron and steel ware depends on the temperature and duration of the thermal chromium plating process. The dependence of the thickness of the diffusion layer on the temperature and time is expressed by the equation: $L = 2\,(At)^{\frac{1}{2}}e^{-B/2T}$ in which $L$ is the thickness of the layer in $\mu$, $T$ the temperature, $t$ the time in seconds, $A$ and $B$ the constant values: $A = 3.55 \times 10^{-5}$; $B =$ 14,800. In practice the thickness of the diffusion chromium layer can be determined fairly accurately by the change in the dimensions of the samples. Increase in the dimensions of the samples in length or width corresponds to the thickness of the diffusion chromium layer formed. Maximum chromium content is on the surface of the object and it decreases gradually toward the core of the object depth-wise in the diffusion layer. Concentration of the chromium at different depths of the diffusion layer can be determined very simply by the usual spectrum method. The objects can be subjected to thermal treatment after the thermal chromium plating. The hardness of the surface layers of the thermal chromium-plated ware is fairly high. Moreover, the diffusion layers considerably increase their resistance to wear. The thermal chromium-plated ware is fairly stable to corrosion in many attacking mediums, including gases at high temperatures, nitric acid and other electrolytes.

Digest from "Diffusion Layers of Chromium on Iron and Steel" by N. C. Gorbunov, *Zhurnal Prikladnoi Khimii* XVII,, No. 9–10, 495–501, 1944. (Published in Russia.)

## PREPARATION OF YEAST EXTRACT BY AUTOLYSIS

ONE of the methods used for preparation of vitamin-rich yeast extracts is by autolysis of the yeast, which process involves digestion of the albumins by the yeast itself or, more specifically, by the yeast enzyme endotryptase. Action of the endotryptase makes the yeast dissolve and brings about destruction of the zymase, the enzyme which produces alcoholic fermentation. Like all substances rich in albumins, yeast is easily contaminated and the autolysis must therefore be carried out so as to avoid putrefaction. Autolysis of the yeast results in formation of aminoacids, particularly lysine, arginine and histidine, which can be transformed by a simple reaction to the toxins cadaverine, putrescine and histamine. This conversion is caused by the enzyine carboxylase contained in putrefaction bacteria. The bacillus botulinus, which is anaerobic, is especially dangerous. A safe product can be produced by autolysis by maintaining a temperature of more than 45 deg. C. and working in an acid medium (a pH of less than 6).

Digest from "Autolysis of Brewers' Yeast" by W. Schmitt and M. Gomez Daza, *Revista Colombiana de Quimica* I, No. 1, 14–15, 1944–45. (Published in Colombia.)

## ESTERIFICATION OF FATTY ACIDS WITH GLYCEROL

WORK done on the rate of esterification of fatty acids with glycerol showed what quantities of catalyst and glycerol should be used, as well as the most favorable temperatures in regard to rate of reaction and preparation of undecomposed products. It was found that the catalytic action of benzenesulphonic acid and *p*-toluenesulphonic acid is practically the same. At 175-185 deg. C. and in the presence of 0.22 percent catalyst, the reaction is practically in equilibrium after 8 hr. of heating, the yield being 82 percent. With 0.5 percent catalyst the yield is still 82 percent and the reaction stops after 5 hr. of heating. When the temperature is raised to 250-260 deg. C., the reaction is rapid and the yield is 96-97 percent, but the product is partially carbonized at the end of 3 hr. The rate of esterification and the yield of esterified fatty acids increases very rapidly when the quantities of glycerol used are greater than those indicated in the theoretical formula for triglycerides, but then there is a distinct predominance of diglycerides. *p*-Toluenesulphonic acid was found to be more advantageous than benzenesulphonic acid.

Digest from "Esterification of Fatty Acids with Glycerol" by Nina Ivanoff, *Bull. Mat. Grasses Inst. Col. Marseille* 29, No. 1–2, 13–19, 1945; *Chimie et Industrie* 53, No. 1, 41, 1945. (Published in France.)

## SYNTHESIS OF VINYL ETHINYL CARBINOLS

ALCOHOLS of the acetylene series can be synthesized by one of two basic methods: (1) By the action of magnesium alkyl halides on oxides, aldehydes, ketones and esters; and (2) by condensation of acetylene and its various derivatives with ketones. The condensing reagent can be metallic sodium, sodium amide, potassium alcoholates and, in particular, pulverulent caustic potash, which was first recommended by A. E. Favorski as far back as 1906. Favorski's method made tertiary acetylene alcohols cheap and easily available. It was also found that under the influence of sodium amide, vinyl acetylene condenses with aliphatic and alicyclic ketones, forming tertitary vinyl ethinyl carbinols with a yield of up to 70 percent. Condensation of vinyl acetylene and isopropenyl acetylene with ketones by the action of pulverulent caustic potash resulted in the corresponding tertiary vinyl ethinyl carbinols with an almost theoretical yield (up to 95 percent). Condensation of vinyl acetylene under the influence of pulverulent caustic potash takes place readily only with saturated aliphatic or alicyclic ketones. Unsaturated ketones (mesityl oxide), aliphatic-aromatic and aromatic ketones (acetophenone, benzophenone), branched ketones of the hexamethyl acetone type, and also oxides and aldehydes cannot enter this condensation. Primary and secondary vinyl ethinyl carbinols, as well as tertiary vinyl ethinyl carbinols with branched or aromatic radicals are prepared most readily by the action of magnesium and bromovinyl acetylene on oxides, aldehydes and corresponding ketones.

Digest from "Chemistry of Vinyl Ethinyl Carbinols" by I. N. Nazarov, *Uspekhi Khimii* XIV, No. 1, 3–41, 1945. (Published in Russia.)

# CHEMICAL ENGINEER'S BOOKSHELF

LESTER B. POPE, Assistant Editor

**THE COMPOSITION OF OCEAN WATER***

| ELEMENT | PERCENT | ELEMENT | PERCENT | ELEMENT | PERCENT |
|---|---|---|---|---|---|
| Oxygen | 85.89 | Bromine | 0.0066 | Zinc | 0.0000071† |
| Hydrogen | 10.80 | Carbon | 0.002 | Phosphorus | 0.000006 |
| Chlorine | 1.93 | Strontium | 0.001 | Iodine | 0.000005 |
| Sodium | 1.07 | Boron | 0.001 | Arsenic | 0.000002 |
| Magnesium | 0.130 | Silicon | 0.0001 | Copper | 0.000001 |
| Sulphur | 0.088 | Fluorine | 0.0001 | Caesium | 0.0000002 |
| Calcium | 0.042 | Rubidium | 0.00002 | Silver | 0.00000003 |
| Potassium | 0.037 | Lithium | 0.000007 | Gold | 0.000000001 |

**From "Raw Materials From the Sea." †"This value appears to be ten times too great."*

## WEALTH IN THE OCEAN

RAW MATERIALS FROM THE SEA. *By E. F. Armstrong and L. M. Miall. Constructive Publications, Ltd., 213 London Road, Leicester, England. 164 pages. 15s.*

DURING millions of years the sea has been receiving vast quantities of substances washed down by innumerable rivers. It has become a veritable storehouse from which, with proper effort, useful materials may be removed. The commonest of these is salt. But the sea offers more. Bromine and magnesium are being extracted in commercial quantities.

Armstrong and Miall, two British industrial scientists, have made quite a study of the elements present in the hydrosphere; how they got there; why they are present in the amounts found; and how, in a few cases, they are extracted.

The study involved several sciences other than chemistry and a widely scattered literature. This book is a first effort to bring such information together. The result makes interesting reading. There are descriptions of the solar salt, the Dow sea water and magnesium processes, Dead Sea potash recovery, and the seaweed-iodine industry. But in addition the reader will learn why the sea, fed by rivers containing equal amounts of potassium and sodium, contains so much more of the latter; why oysters need copper; why and how the pH of ocean water varies from 7.8 to 8.8; how much arsenic there is in a lobster. These and other facts combine to emphasize the authors' contention that, although little use has been made of them, the oceans are not the least among the world's mineral resources.

## BUSINESS ADMINISTRATION

PRACTICAL MANAGEMENT RESEARCH. *By Alexis R. Wiren and Carl Heyel. McGraw-Hill Book Co., New York. 222 pages $2.50.*

*Reviewed by Blaine K. McKee*

PRACTICAL MANAGEMENT RESEARCH is another in the McGraw-Hill Industrial and Management series, and it is a good one. Both of the authors, having been associated for many years with men directing diversified businesses, possess the background necessary for writing this book, which fills a real need as it was written after one of the authors made an unsuccessful search for a book devoted entirely to management research. It utilizes scientific methods in solving problems instead of the haphazard "hunch" or intuitive system. Wiren and Heyel tell of "the 'Rube Goldberg' complex of a mechanical minded executive vice-president, which resulted in a plant full of complicated conveyor and materials-handling equipment, whereas an analysis by a motion and time-study engineer later showed that relayout of processes and improvement of specific operations would have made most of the mechanization unnecessary." It is in preventing this type of solution to management problems that this book has its value.

In the text many typical business situations are discussed. Under the administration of business the authors go into detail on the importance of formulating long-time company policies, having clear cut lines of authority, and the developing of company, industry, and general economic indexes. In addition, among others, problems of production, markets, personnel, and advertising sales are included. Case examples of problems solved by use of scientific method show the excellent results obtained by use of this method. But more important than these case records or the discussion of typical problems is the approach advocated to any problems—"In all teps—get the facts—face the facts—interpret the facts—get opinions—place opinions in proper perspective."

The book is a well written contribution to business management. Wiren and Heyel have written in a clear interesting style which makes it enjoyable as well as informative reading.

## PERFECTION

ELECTRON OPTICS AND THE ELECTRON MICROSCOPE. *By V. K. Zworykin, G. A. Morton, E. G. Ramberg, J. Hillier and A. W. Vance. John Wiley & Sons, New York. 766 pages. $10.*

*Reviewed by Emy Henning Nachod*

ELECTRON microscopy is a very young field. In the short span of ten years rapid advances have been made. The laws and phenomena of optics were translated into electron optics and it took more than mere reasoning by analogy to achieve that goal.

Here for the first time is an authoritative and integrated treatise on electron optics and its most important instrumental application, the electron microscope. It has been compiled by a team of five experts of the RCA Laboratories in Princeton, under the leadership of the distinguished Dr. Zworykin.

The book is divided in two approximately equal parts, the first comprising electron optics and electron microscopy and the second devoted to theory.

One is impressed with the amazing degree of completeness presented in this book. For example, a technician who wishes to learn the difficult techniques employed in the preparation of specimens can find the desired information by turning to p. 243 ff., just as a teacher may educate himself about the correlation of aberration of conventional and electron lenses, (p. 540 ff.).

The book is profusely illustrated and the publishers seem to have spared no expense to make it a success. It is very rare that one comes across a "perfect" book. The present

### RECENT BOOKS RECEIVED

**American Chemical Industry.** Vol. III. By Williams Haynes. Van Nostrand. $8.

**Atomic and Free Radical Reactions.** By E. W. R. Steacie. Reinhold. $8.

**The Electron Microscope.** By E. F. Burton & W. H. Kohl. Reinhold. $4.

**The Engineer in Society.** By John Mills. Van Nostrand. $2.50.

**Essentials of General Chemistry.** By B. S. Hopkins & J. C. Bailar, Jr. Heath. $3.50

**Haskh's Chemical Dictionary.** 3rd ed., 2nd printing. Ed. by J. Grant. Blakiston. $8.50.

**Modern Plastics.** By H. Barron. Wiley. $7.50.

**Petroleum Production.** Vol. I. By Park J. Jones. Reinhold. $4.50.

**Poisons.** By Vincent J. Brookes & H. N. Alyea. Van Nostrand. $3.

**Psychrometric Tables and Charts.** By O. T. Zimmerman & I. Lavine. Industrial Research Service. $6.50.

text, in the reviewers opinion, is one of these rare occurrences and does not require any recommendations, since it seems to recommend itself upon even only a brief examination.

### TRANSLATED & REVISED

ORGANIC PREPARATIONS. *By Conrad Weygand. Interscience Publishers, New York. 534 pages. $6.*

*Reviewed by F. C. Nachod*

PART II of Weygand's "Organisch-chemische Experimentierkunst" which came out in 1938 now makes its re-appearance in a new coat. The result is quite a remarkable text. It is not a beginner's book as it does not constitute descriptive organic chemistry, yet it is not merely a dull accumulation of reactions. Procedure in organic chemistry in the author's eyes is primarily an experimental art. Thus it is not surprising that the approach is not based on functional groups of compounds but on the formation and fission of the various bonds. Each reaction is then illustrated by one or more descriptive preparations and ample documentation by literature references, especially to organic syntheses, is provided.

The author has produced a mature and advanced text which will find its place on the bookshelves of the teacher and the researcher.

The translation is readable, and paper, print and make-up of the book are excellent.

### ADDENDUM

THE AUTHOR of "Chemicals and Food Production," reviewed on these pages last month, has indicated a correction should be made on p. 48 of his book. In table VI entitled "U. S. Imports of Pyrethrum" there was no heading over the sixth column. This should have been headed "Belgian Congo." The fifth column was incorrectly headed Belgian Congo and should have been headed "British East Africa."

## RECENT BOOKS and PAMPHLETS

**Betz Handbook of Industrial Water Conditioning.** Published by W.H. & L.D. Betz, Gillingham and Worth Sts., Philadelphia 24, Pa. 171 pages. A complete handbook of water treatment and water analysis.

**The Training Within Industry Report.** For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 330 pages; 50 cents. A narrative account of the work of TWI, one of the oldest wartime government agencies, including what it learned about in-plant training as a production tool.

**Design Standards for Inserts—Their Application in Plastics Parts.** Published by The Society of the Plastics Industry, 295 Madison Ave., New York 17, N. Y. 27 pages. SPI Handbook advance chapter 2 representing the work of leading technicians in the industry.

**A Medical Study of the Effect of TNT on Workers in a Bomb and Shell Loading Plant.** Public Health Bulletin No. 291, available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 98 pages; 25 cents. Results of a study among workers after one year of plant operation.

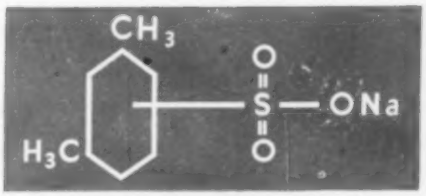
**Manual Sheet N-1.** Published by Manufacturing Chemists' Association, 608 Woodward Bldg., Washington, D. C. 4 pages; 10 cents. Handling of Nitrocellulose Wet With Alcohol (or Other Organic Liquid) or Water While in I.C.C. Containers; in Storage or in Process. Revised manual sheet of recommended practice.

**Opportunity.** Published by Contra Costa County Development Association, 337 Tenth St., Richmond, Calif. 12 pages. A folder that briefs the industrial facilities, transportation, utilities and

# WYANDOTTE SODIUM XYLENESULFONATE

## FOR HYDROTROPIC SOLUTIONS · a chemical with * U.C.P.

**INCREASES THE SOLUBILITY OF MANY ORGANIC AND INORGANIC COMPOUNDS IN AQUEOUS SYSTEMS**




MOLECULAR WEIGHT 208

**Sodium xylenesulfonate is available from semi-commercial production. Address inquiries for samples and further information to the Development Department. Wyandotte's technical staff stands ready to aid you.**

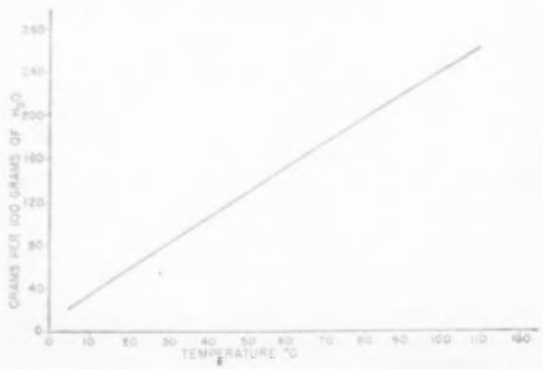
### HYDROTROPIC PROPERTIES

Solutions of sodium xylenesulfonate have the property of "salting in" or increasing the solubility of many slightly soluble chemicals in aqueous systems. This unique property makes sodium xylenesulfonate attractive for numerous processes employed in the chemical industry. It is suggested for solvent extraction, speeding up chemical reactions, lowering of the reaction temperatures required for certain reactions, as a mutual solvent for increasing the solubility of organic compounds in aqueous systems, speeding up two-phase (liquid-liquid) organic reactions, for purifying organics, as a solvent for lignin and pentosans, and for increasing the water solubility of many sparingly soluble inorganic salts.

### PHYSICAL AND CHEMICAL PROPERTIES

Wyandotte sodium xylenesulfonate is available as an aqueous solution in which the approximately 40% solids are primarily the sodium sulfonate derivatives of the 1,3-isomer with small amounts of the derivatives of the 1,2-isomer. The solution is straw colored, slightly alkaline (pH at 25°C,—7.5 to 8.5), has a faint sweet odor and contains less than 2% inorganic salts. Solutions of sodium xylenesulfonate exhibit moderate wetting properties.

### SOLUBILITY OF THE ANHYDROUS SALT IN WATER




* U.C.P. means Undiscovered Commercial Potential

Wyandotte
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*OFFICES IN PRINCIPAL CITIES*

**WYANDOTTE CHEMICALS CORPORATION**
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•

**Soda Ash • Caustic Soda • Bicarbonate of Soda**
**Calcium Carbonate • Calcium Chloride**
**Chlorine • Hydrogen • Sodium Zincates**
**Aromatic Intermediates • Dry Ice • Other Organic and Inorganic Chemicals**

natural advantages of Contra Costa county on San Francisco Bay. Includes a detailed map.

**Chemistry in Aircraft Maintenance.** Published by Turco Products, Inc., 6135 South Central Ave., Los Angeles 1, Calif. 28 pages. A series of articles dealing with chemistry in the care and maintenance of aircraft: corrosion, surface coatings, preparation of aluminum surfaces and cleaning of transparent plastics. Well illustrated.

**Manufacturers Directory for San Francisco Bay Region.** Published by San Francisco Chamber of Commerce, San Francisco, Calif. 36 pages. A mimeographed booklet listing manufacturing firms in 12 San Francisco Bay region counties that employ 100 or more persons. Lists the office address and plant location of each firm, manager, telephone number, number of employees and type of products. Includes most of the large chemical and related firms of the Bay region.

**San Francisco and the Bay Area, 1945.** Published by the Research Dept., San Francisco Chamber of Commerce. 35 pages. A survey containing detailed statistical data covering a period of years on the business, industrial, market and economic conditions in San Francisco and the Bay area.

**The California Trend.** Published by the Bank of America, 300 Montgomery St., San Francisco 20; 660 S. Spring St., Los Angeles 54. 25 pages. A factual survey of population, buying power, business, industry and the three major California markets. Contains statistics in the form of maps, charts and graphs.

**Horizons.** Published by Byron Jackson Co., P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif. 72 pages. A comprehensive survey of the history and growth of this company and of the development of its products. Contains photographs, diagrams and descriptive material.

**Wood Products for Fertilizer.** Bulletin No. 7, published by Northeastern Wood Utilization Council, P. O. Box 1577, New Haven 6, Conn. 72 pages; $1. Report of conference at Orono, Me., June 29, 1945.

## GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publication noted in this list always give the complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

**A Survey of the Properties of Commercial Water Repellents and Related Products.** By F. L. Browne and L. E. Downs. Forest Products Laboratory, Madison, Wis. No. R1495. Processed.

**Durability of Room-Temperature-Setting and Intermediate-Setting Resin Glues Cured to Different Degrees in Yellow Birch Plywood.** By John M. Black and H. D. Bruce. Forest Products Laboratory, Madison, Wis. No. 1537. Processed.

**Water-Resistant Glues.** Forest Products Laboratory, Madison, Wis. Technical Note Number F-4. Processed leaflet.

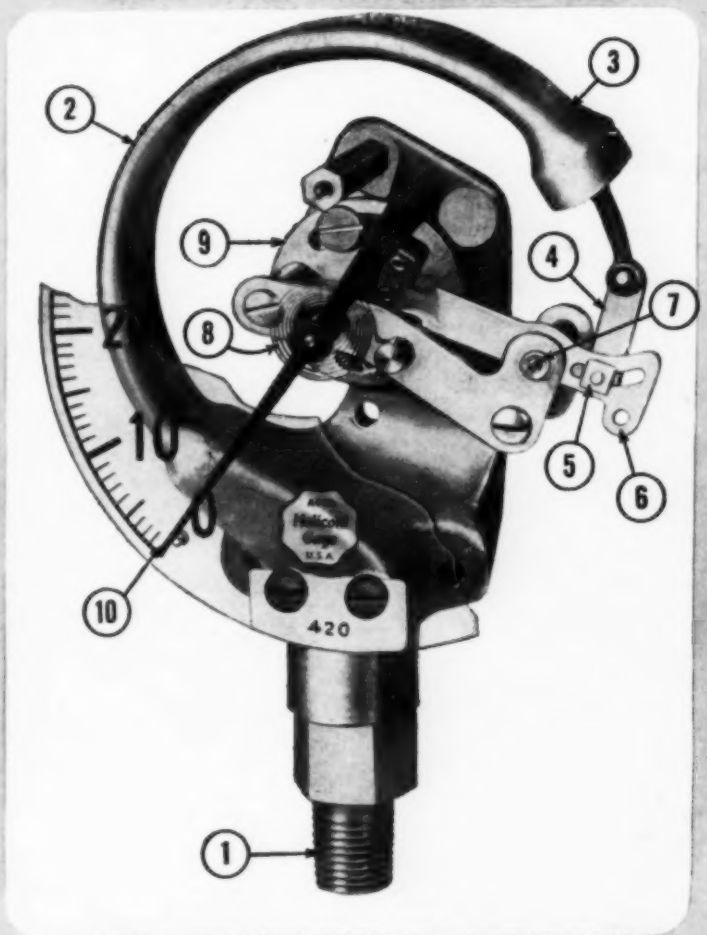
**Durability of Papreg-to-Papreg and Papreg-to-Birch Glued Joints.** By Herbert W. Eickner. Forest Products Laboratory, Madison, Wis. No. 1538. Processed.

**Development of a Counterpart Vertical Fin of Papreg for the AT-6 Airplane.** By E. C. Jungmann. Forest Products Laboratory, Madison, Wis. No. 1594. Processed.

**Preservation of Timber by the Steeping Process.** Forest Products Laboratory, Madison, Wis. No. R621. Processed.

**Influence of Temperature on Relative Humidity**

# How the Helicoid Gage Works




***PRESSURE*** enters the socket **(1)** connected to pressure source. Pressure to be measured may be air, steam, water, oil, or any liquid or gas. Thru socket, the pressure enters Bourdon tube **(2)**.

***BOURDON TUBE*** **(2)** is an oval-shaped tube of semi-circular form with a sealed end **(3)**. Any pressure in the tube, in excess of external or atmospheric pressure, causes tube to assume a more circular cross section. The flat sides are therefore forced apart, and the tube tends to straighten out at the free end, and tip **(3)** moves outward. The reverse effect occurs under vacuum, when the pressure in the tube is less than the external or atmospheric pressure. This movement of the tube at the free end is called tip travel. In principle, it's just as simple as blowing into a limp glove, causing the fingers to move as they fill with air. As the tube tends to straighten, the tip **(3)** moves outward. On vacuum (pressure below atmospheric) the tip moves inward.

***CONNECTING LINK*** **(4)** connects the tip of Bourdon tube to movement slide nut **(5)**. The tip end of the link travels in a straight line while the movement cam **(6)** travels in an arc around pivot **(7)**.

***MOVEMENT SLIDE NUT*** **(5)** which joins the connecting link **(4)** to the movement cam **(6)** is adjustable, and is used for calibrating gage. Lengthening or shortening distance of slide nut **(5)** from pivot **(7)** is necessary to get exact relationship required to translate the travel at the tip to a 280° revolution of the pointer shaft. Moving the slide nut outward decreases amount of travel of pointer. Moving slide nut inward increases the pointer travel. The Helicoid movement is made with this adjustment at the rear. Hence, the Helicoid Gage can be calibrated as a unit by removing the entire system from the case, but without removing the pointer and the dial. This saves much time when calibrating.

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***POINTER*** **(10)** travels uniformly around dial for equal changes in pressure, if the gage is in calibration.

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**Chemical Utilization of Wood: Its Opportunities and Obstacles.** Forest Products Laboratory, Madison, Wis. By Alfred J. Stamm. No. R1601. Processed.

**List of Publications on Chemistry of Wood and Derived Products.** Forest Products Laboratory, Madison, Wis. No. R238. Processed.

**Mining and Milling Operations of the Southwestern Graphite Co., Burnet County, Texas.** By A. B. Needham. Bureau of Mines, Information Circular I. C. 7339. Mimeographed.

**Concentration of Oxide Manganese Ores From Clallam County, Wash. (Madeline, Lakeview, and Victory Claims).** By T. F. Mitchell and Walter J. Long. Bureau of Mines, Report of Investigations, R. I. 3837. Mimeographed.

**Washability Characteristics and Washing of Coals From the Matanuska Field of Alaska.** By M. R. Geer and H. F. Yancey. Bureau of Mines, Report of Investigations, R. I. 3840. Mimeographed.

**Tungsten Deposits of the Southern Part of Sonora, Mexico.** Geological Survey Bulletin 946-D. Price 15 cents.

**The Liquidation of War Surpluses.** Quarterly Progress Report to the Congress by the Surplus Property Administration. Fourth Quarter 1945. War Surplus Property Board. Unnumbered printed.

**Economic Controls and Commercial Policy In Mexico.** U. S. Tariff Commission. Price 15 cents.

**Distribution Cost Analysis.** By Charles H. Sevin. Bureau for Foreign and Domestic Commerce. Economic Series No. 50. Price 15 cents.

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**Postwar Packages and Containers for Marketing Foods.** By Delbert R. French. Department of Agriculture, Bureau of Agricultural Economics. Unnumbered mimeographed.

**Use of DDT in Control of Flies on Cattle and Around Farm Buildings.** By H. H. Stage. Bureau of Entomology and Plant Quarantine. E-675. Mimeographed.

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**Insecticidal Action of Organic Halogen Compounds—A Comparison of Selected Literature References.** By C. V. Bowen and H. L. Haller. Bureau of Entomology and Plant Quarantine. E-678. Mimeographed.

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**Manning Creek Alunite Deposit, Marysvale, Utah.** Geological Survey, Preliminary Map 3-192.

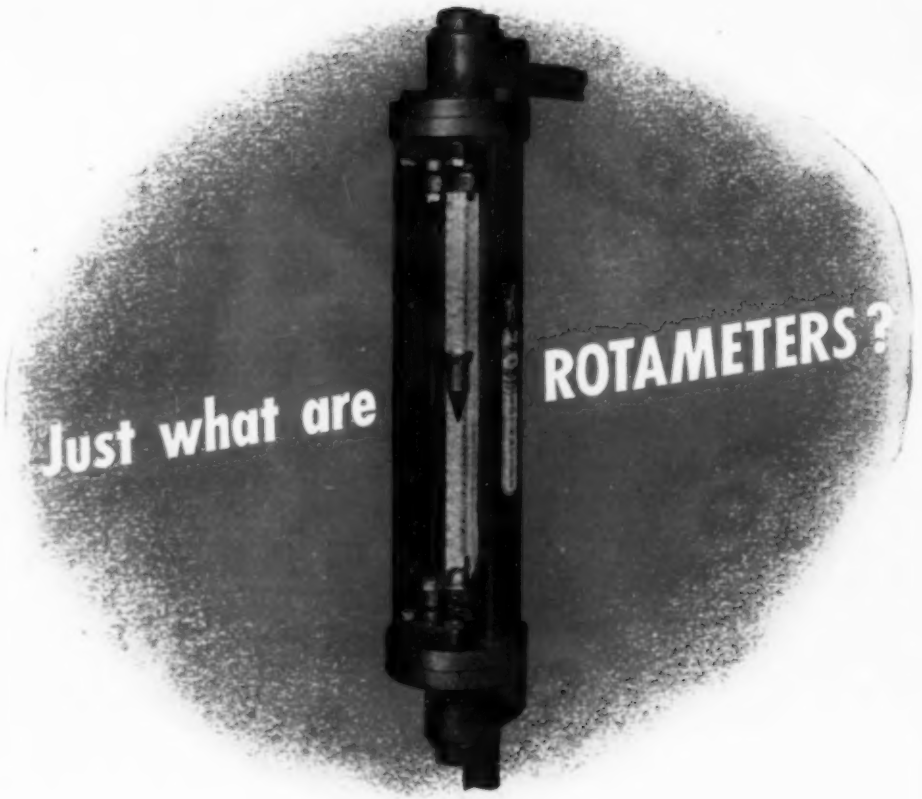
**Tables of Food Composition in Terms of Eleven Nutrients.** Bureau of Human Nutrition and Home Economics. Department of Agriculture Miscellaneous Publication No. 572. Price 10 cents.

**Aircraft Metal Work.** Prepared by Bureau of Naval Personnel. Navy Training Courses, Edition of 1945. Price 50 cents.

**Aircraft Hydraulic Equipment.** Prepared by Bureau of Naval Personnel. Navy Training Courses, Edition of 1945. Price 35 cents.

**American Standard Building Code Requirements for Minimum Design Loads in Buildings and Other Structures.** Bureau of Standards Miscellaneous Publication M179. Price 10 cents.

**Bibliography of Scientific and Industrial Reports.** A weekly publication giving abstracts of documents distributed by The Office of The Publication Board. Subscription by advance deposit of $10 for an indeterminate period.

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*Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterheads.*

**Anti-Foaming Agents.** L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.—Technical data file featuring the use of Blandol, a white mineral oil which minimizes foaming during the fermentation process in penicillin manufacture.

**Alloys.** Ampco Metals, Inc., 1745 So. 38th St., Milwaukee 4, Wisconsin—Bulletin 72. 4-page leaflet featuring the aluminum bronze products made by this company.

**Aluminum Paint.** Crescent Bronze Powder Co., 118 W. Illinois St., Chicago 10, Ill.—A handy, pocket-size aluminum paint indicator or slide rule is designed to aid in the selection of the right aluminum paint for a specific purpose. Includes information on how to prepare any given surface before painting, how many square feet of coverage for particular types of surfaces, and the types of structures to which the paint is applicable.

**Ball Mills.** The Mine & Smelter Supply Co., Denver, 17, Colo.—Catalog No. 101. 32-page catalog featuring the Marcy Milling equipment manufactured by this company. The principle of operation is discussed and the various types of equipment are described and illustrated in detail. Diagrammatic sketches illustrate complete milling plants of various kinds.

**Blowers.** National Association of Fan Manufacturers, General Motors Bldg., Detroit 2, Mich. Bulletin No. 105. 12-page booklet entitled "Standards, Definitions, and Terms in Use by the Fan and Blower Industry." Includes definitions of the various types of fans giving standard sizes, drive arrangements, and other data. Booklet is well illustrated and contains data on fan testing, performance, etc.

**Boiler Control.** Northern Equipment Co., Erie, Pa.—Bulletin 441. 24-page bulletin featuring Copes feed water control for high-duty boilers. The principle of operation of the Copes Flowmatic system is explained and its characteristics and features are given. Diagrammatic sketches are used to illustrate the action of this system and installation diagrams are given. Bulletin 445. Four-page leaflet featuring a Copes flowmatic installation on a high-pressure boiler.

**Case Hardening.** Surface Combustion Corp., Toledo 1, Ohio—Bulletin No. SC-127. 4-page leaflet featuring this company's line of furnaces for case hardening. Bulletin No. SC-128. Four-page leaflet illustrates and describes the application of radiant tube heating which is applicable to various types of heat-treatments and processes. Includes a chart giving the available heat of artificial, natural, propane and butane gases.

**Classifier.** Bird Machine Co., South Walpole, Mass.—8-page illustrated booklet featuring the Bird continuous centrifugal classifier. Principles of operation are described and illustrated.

**Coated Fiberglas Cloth.** Owens-Corning Fiberglas Corp., Toledo 1, Ohio—4-page leaflet featuring wartime applications of coated Fiberglas cloth. Many new peacetime uses are suggested for this versatile material. Fiberglas cloth is coated with neoprene, neoprene-aluminum pigment and vinyl resins.

**Coatings.** Protective Coatings Corp., 689 Main St., Belleville, N. J. 16-page brochure describing Aquastop synthetic impregnated waterproof coated case liners. This brochure illustrates and describes the steps in applying Aquastop to shipping case panels as well as the methods used in sealing these cases.

**Compressors.** Clark Bros. Co. Inc., Olean, N. Y.—8-page brochure featuring the Grapeland Cycling Plant at Grapeland, Texas.

**Conveyors.** Brady Conveyors Corp., 20 W. Jackson Blvd., Chicago, Ill.—22-page booklet illustrating and describing the pneumatic conveyor systems furnished by this company. Various systems are described including suction systems,

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**Electric Motors.** Electric Indicator Co., Stamford, Conn.—12-page booklet illustrating and describing Elinco type "FB" motors and generators. Includes data on construction, characteristics and performance of this equipment. Contains performance curves for the different motors and generators.

**Electrical Equipment.** Delta-Star Electric Co., 2400 Fulton St., Chicago, Ill.—Bulletin 4601. Pamphlet illustrates and describes outdoor substation multi-pole high-pressure contact, high-voltage switches manufactured by this company.

**Flotation.** The Mine & Smelter Supply Co., Denver 17, Colo.—8-page leaflet featuring the Massco-Fahrenwald flotation machine manufactured by this company. The principles of design construction and operation are shown, and dimensions, together with capacities, are given.

**Furnaces.** Laboratory Equipment Corp., Benton Harbor, Mich.—4-page booklet featuring the Leco 2600 high-temperature combustion furnace for laboratory use.

**Gas Masks.** Manufacturers Sales Co., Kalamazoo, Mich—8-page folder featuring the Scott Air-Pak self-contained breathing apparatus distributed by this company. The various types of breathing apparatus are illustrated and described, and its use in various applications is shown.

**Heat Transfer Equipment.** Griscom-Russell Co., 285 Madison Ave., New York, N. Y.—Bulletin 1230. 8-page pamphlet illustrating and describing the K-Fin air-cooled section applied to the Fin-Fan heat exchanger. The Fin-Fan air-cooled heat exchanger is described in principle and illustrated by diagrams. A number of typical applications of this equipment are given.

**Hose Fittings.** Eastman Manufacturing Co., Manitowoc, Wis.—Catalogs 46A and 46H. Two catalogs covering the complete line of hose couplings and fittings for all types of industrial applications made by this company.

**Hose Fittings.** B. F. Goodrich Co., Akron, Ohio—Catalog Section 3100. 4-page folder illustrating this company's line of hose fittings, including couplings, joints, clamps, washers, nozzles, nipples and flanges.

**Humidity Control.** Kathabar Div., of Surface Combustion Corporation, Toledo, Ohio—The first issue of this company's new house organ, entitled "The Moisture Engineer" is now available. Features the psychrometric approach to dehumidifying and humidifying problems for commercial application.

**Industrial Hose.** Hewitt Rubber Corp., Buffalo 5, N. Y.—16-page booklet illustrating and describing the various types of industrial hose manufactured by this company. Includes data on hoses for general use, fire protection, oil industries, food industries, etc. The features of each type of hose are briefly described and the sizes are given.

**Industrial Survey.** Ford, Bacon & Davis, Inc., 39 Broadway, New York 6, N. Y.—12-page brochure discussing the relative merits of locating plants in various geographical areas throughout the U. S.

**Insecticides.** Hercules Powder Co., Wilmington, Del.—32-page booklet illustrating and describing the Thanite family of insecticides manufactured by this company. Includes data on various DDT concentrates, together with information on methods of control over a number of common insects and pests.

**Instruments.** The Bristol Co., Waterbury, Conn. Catalog No. W-1800. 24-page catalog covering the Bristol line of automatic controlling, recording and indicating instruments. Specification data is given on the various instruments. Application information is included.

**Instruments.** Marion Electrical Instrument Co., Manchester, N. H.—28-page catalog covering the electrical indicating instruments manufactured by this company. Features of design, together with specifications and applications of these instruments are given. Includes section on ordering information.

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**Magnet.** Prater Pulverizer Co., 1825 So. 55th Ave., Chicago 50, Ill.—4-page illustrated leaflet describing the Prater certified permanent magnet. Specifications, and dimensions are given.

**Materials Handling.** The Elwell-Parker Electric Co., Cleveland, Ohio—4 bulletins discussing types of loads and economical methods of handling them are entitled the Logistics of Boxes, the Logistics of Barrels, the Logistics of Bags, and the Logistics of Bales.

**Polyvinyl Materials.** B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, Ohio—6-page booklet featuring Geon polyvinyl resins, plastics and other chemicals manufactured by this company.

**Portable Elevators and Lift Trucks.** Revolvator Co., Tonnele Ave. at 86th St., North Bergen, N. J.—Bulletin 961D2, 4-page leaflet featuring the portable elevators made by this company. Bulletin 95K2, 4-page folder featuring the Red Giant lift truck made by this company.

**Product Research.** Evans Chemetics, Inc., 250 E. 43rd St., New York 17, N. Y.—16-page brochure describing the manufacturing and research facilities of this company which is engaged in product research and private-label manufacture of chemical products.

**Protective Coatings.** Prufcoat Laboratories, Inc., 50 East 42d St., New York 17, N. Y.—14-page booklet illustrating and describing the acid-proof, alkali-proof, oilproof and waterproof coatings used on equipment and structures for the chemical industries.

**Pumps.** Blackmer Pump Co., Grand Rapids 9, Mich.—6 page illustrated booklet entitled "Facts About Rotary Pumps." This booklet features the bucket design (swinging vane) principle used in these pumps.

**Pumps.** Marlow Pumps, Ridgewood, N. J.—Bulletin M45. 12-page illustrated booklet featuring the Marlow Mudhog diaphragm pumps made by this company. Specifications and characteristics of these pumps are shown.

**Pumps.** Oliver United Filters, Inc., 33 W. 42nd St., New York, N. Y.—Bulletin 309 6-page folder featuring the diaphragm slurry pumps made by this company. Discusses applications, special designs, capacities, and includes instructions and installation information.

**Tackifiers.** Hercules Powder Co., Wilmington, Del. 6-page technical bulletin describing Pentalyn A and Pentalyn H, tackifying resins particularly applicable in pressure sensitive adhesives based on synthetic rubber. Properties, resin emulsion formulas, methods of preparation of resin emulsions and other information is included.

**Textile Equipment.** The Mathieson Alkali Works, 60 E. 42nd St., New York 17, N. Y.—8-page illustrated pamphlet describing this company's steamer for continuous open-width processing of cotton and rayon fabrics. Construction and operation of this piece of equipment are discussed in detail.

**Thermocouples.** Arklay S. Richards Co., Inc., 72 Winchester St., Newton Highlands, 61, Mass. Catalog No. 41. 16-page catalog featuring the complete line of standardized industrial thermocouples and accessories for use with all types of pyrometers. Included is data on thermocouple protecting tubes and welds, thermocouple wires, thermocouple lead wires, insulators, and other accessories. Specifications, sizes, materials of construction, together with list prices are given.

**Thermodynamics.** Foster Wheeler Corp., 165 Broadway, New York 6, N. Y.—Reprints of the paper "Hydrocarbon Thermodynamics" presented at the November, 1945 meeting of the California Natural Gasoline Association in Los Angeles are available from this company.

**Transformers.** Sola Electric Co., 2525 Claybourn Ave., Chicago 14, Ill. Bulletin CV-102. 32-page booklet illustrating and describing the constant voltage transformers manufactured by this company. Gives information on the construction of this type of equipment together with information on operation and use of the various types and models.

**Ventilating Systems.** ILG Electric Ventilating Co., 2850 N. Crawford Ave., Chicago 41, Ill.—Form No. 103. 34-page brochure featuring the products and manufacturing facilities of this company. The manufacture of centrifugal blower equipment is illustrated and described.

**X-Rays.** North American Phillips Co., Inc., 100 E. 42nd St., New York 17, N. Y.—12-page booklet describing Norelco industrial X-ray equipment for fluoroscopy, radiography, diffraction, and spectrometry. Types of equipment are illustrated and described and a selection is devoted to the application and use of X-ray equipment to various types of products.

# CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

## DROP IN GENERAL INDUSTRIAL OUTPUT FAILS TO CHECK HIGH RATE OF OPERATIONS AT CHEMICAL PLANTS

PRODUCTION of industrial chemicals turned upwards in January with the index of the Federal Reserve Board standing at 388 compared with a revised figure of 380 for December. As measured by the index, output of chemicals in January was but little below that for the comparable month last year and less than 6 percent under the all-time peak reached in the war period. A review of individual production statistics, however, reveals that the upward swing did not extend to all branches of the industry. The January tonnage for caustic soda showed an increase but this resulted from higher outputs at lime-soda plants which more than offset a drop in the electrolytic product. Because chlorine stocks have begun to accumulate, chlorine plants are curtailing operations with a corresponding effect on the output of electrolytic caustic.

Among the heavy tonnage chemicals which showed larger outputs in January was soda ash which has not yet caught up with the backlog of orders which piled up when some plants were closed last year because of labor troubles. Another factor affecting ash is that consuming demand has dropped little if any from the wartime peak. For instance, glass container production in January was the second largest for any month on record and container plants are expected to operate at close to capacities for at least the first half of this year. In the latter part of the year there is the possibility the flat glass industry will greatly expand its requirements for ash.

While such basic chemicals as calcium carbide, carbon dioxide, nitric and phosphoric acids, silica gel, and phosphate and silicate of soda gained ground in January there is a rather lengthy list of chemicals which were turned out in smaller volume in January than in December. This list includes sulphuric, hydrochloric, and hydrofluoric acids, ammonia, chlorine, bicarbonate and bichromate of soda, and salt cake.

In sharp contrast to the position of chemicals, the Federal Reserve Board reports that industrial production dropped to its lowest level since early in 1941 with the index for January standing at 155 compared with a revised figure of 161 for December and an all-time high of 249 reached in October 1943. Hence general production has fallen about 38 percent from its wartime peak while chemical production has dropped less than 6 percent from its high point.

Distribution of chemicals has not been entirely free from the problems of reconversion, work stoppages, and wage adjustments which have beset many of the consuming industries. As a matter of fact, production of copper sulphate has been greatly curtailed in recent weeks due to strikes at two producing plants. The other factors are apparent in the movement of the *Chem. & Met.* index for consumption of chemicals which dropped to 181.37 in January as compared with a revised figure of 182.46 for December. The decline in production of sulphate of ammonia at byproduct coke plants and the closing of steel mills cut consumption of chemicals in those lines and this accounted for the greater part of the drop in total consumption of chemicals in that month. The effects of the steel strike were more apparent in February as the index number for that month rests at 2.02 as compared with 7.58 reported for January. Distribution of chemicals may be more affected in the immediate future because of the transfer of box cars from the movement of general merchandise to the delivery of grains.

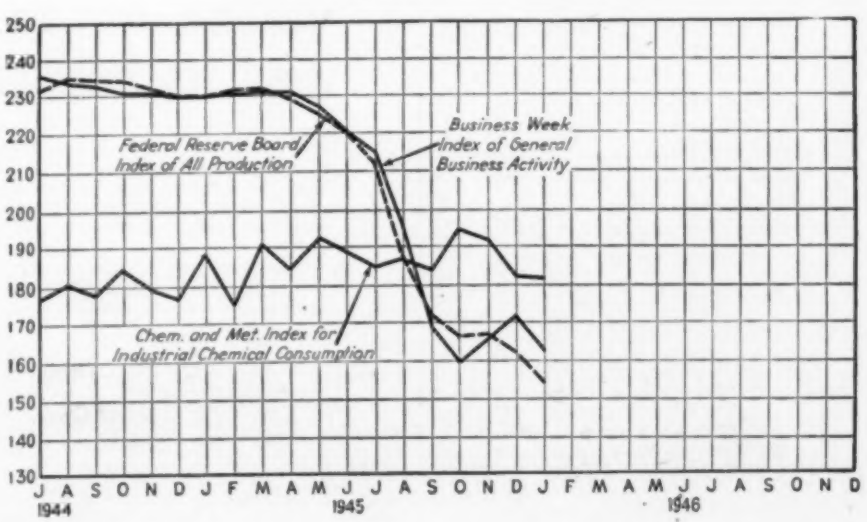
Production of some chemicals promises to be stimulated by developments in the rubber situation. In the first place the amount of natural rubber to be made available to domestic consumers this year is becoming more indefinite and earlier estimates have been lowered with the result that the plant at Institute, W. Va., which was closed in the latter part of last year, has been ordered to continue the manufacture of butadiene from alcohol. In addition to reports that tire outputs are growing in volume and the tendency to revise upwards, earlier estimates for rubber requirements as well as to lower estimates of probable rubber imports, a report of a committee which was requested to survey the rubber industry, has recommended that the domestic stockpile of natural rubber be increased which if adopted will further curtail the supply of the natural product. Hence increased production of butadiene, styrene, and alcohol may be in prospect although part of domestic alcohol requirements are now being met from government stockpiles. Furthermore, the use of grain in the manufacture of alcohol is not permitted and imports of molasses have not been coming to hand in the quantities expected.

The outlook for fertilizer chemicals has become somewhat involved with the loss in sulphate of ammonia being felt at a time when other nitrogen-bearing materials were none too plentiful. Ordnance plants have been turning out ammonia for fertilizer use and production in that quarter is expected to be speeded up. The demands for potash salts have been large enough to bring out requests that the wartime controls on distribution be continued. In the face of this raw material situation, the Secretary of Agriculture, last month called upon farmers to increase their 1946 plantings of grain and food crops by more than 3,200,000 acres.

Production of insecticides has been reduced by shortages in rotenone and nicotine. The closing of smelters has cut production of copper sulphate and arsenic.

***Chem. & Met.* Index for Industrial Consumption of Chemicals**

| | Dec. 1945 Revised | Jan. 1946 |
|---|---|---|
| Fertilizers | 38.98 | 38.60 |
| Pulp and paper | 19.70 | 20.55 |
| Petroleum refining | 18.62 | 18.50 |
| Glass | 19.30 | 21.60 |
| Paint and varnish | 13.92 | 15.80 |
| Iron and steel | 11.11 | 7.58 |
| Rayon | 18.68 | 18.40 |
| Textiles | 9.27 | 10.83 |
| Coal products | 9.46 | 6.47 |
| Leather | 4.60 | 4.65 |
| Industrial explosives | 5.07 | 5.24 |
| Rubber | 6.70 | 6.90 |
| Plastics | 6.05 | 6.25 |
| | 182.46 | 181.37 |



## CARRYOVER OF NAVAL STORES DECLINED LAST YEAR

Most recent data for the naval stores industry are those released in February by the Department of Agriculture. The data, compiled by the Naval Stores Research Division, cover the final quarter of last year with comparable figures included for 1944. This review definitely expresses the extent to which carryover stocks of naval stores declined in the last calendar year. At the beginning of 1945 the carryover of turpentine was 349,092 bbl. and at the end of the year there was a visible supply of only 150,098 bbl. In the case of rosin, the carryover on January 1 was reported at 572,839 drums and on December 31 at 479,890 drums. Incidentally in our report on rosin in the January issue (p. 109) the quantities were expressed in terms of 500-lb. bbl. whereas the figures referred to drums of 520 lb. net.

Reviewing the figures for the final quarter of last year it is found that production of turpentine and rosin made a favorable showing as compared with the like period of 1944. Apparent domestic consumption was off slightly for turpentine with a rather sharp drop in the use of rosin. Export trade in both products was on a larger scale and total disappearance for the quarter exceeded production plus imports by 15,228 bbl. Total gain in stocks of rosin was 6,744 drums made up of production and imports.

**Supply and Apparent Consumption of Turpentine**
**(50-Gal. Bbl.)**

| | Oct.-Dec., 1946 | | | Oct.-Dec., 1945 | | |
|---|---|---|---|---|---|---|
| | Total | Gum | Wood | Total | Gum | Wood |
| Carryover, Oct. 1 | 165,326 | 123,460 | 41,866 | 258,443 | 233,151 | 25,292 |
| Production | 121,099 | 60,580 | 60,519 | 118,119 | 59,205 | 58,914 |
| Imports | 1,926 | 1,926 | ..... | 2,749 | 2,749 | ..... |
| Available supply | 288,351 | 185,966 | 102,385 | 379,311 | 295,105 | 84,206 |
| Carryover, Dec. 31 | 150,098 | 105,517 | 44,581 | 249,092 | 217,720 | 31,372 |
| Apparent consumption | 138,253 | 80,449 | 57,804 | 130,219 | 77,385 | 52,834 |
| Exports | 19,367 | 11,651 | 7,716 | 10,081 | 6,396 | 3,685 |
| Domestic consumption | 118,886 | 68,798 | 50,088 | 120,138 | 70,989 | 49,149 |

**Supply and Apparent Consumption of Rosin**
**(Drums, 520 Lb. Net)**

| | | | | | | |
|---|---|---|---|---|---|---|
| Carryover, Oct. 1 | 473,146 | 325,927 | 147,209 | 661,594 | 526,639 | 134,955 |
| Production | 375,591 | 186,057 | 189,444 | 347,559 | 181,808 | 165,751 |
| Imports | 469 | 469 | ..... | 3,603 | 3,603 | ..... |
| Available supply | 849,116 | 512,463 | 336,653 | 1,012,756 | 712,050 | 300,706 |
| Carryover, Dec. 31 | 479,890 | 310,545 | 169,345 | 572,839 | 442,394 | 130,445 |
| Apparent consumption | 369,225 | 201,918 | 167,308 | 439,917 | 269,656 | 170,261 |
| Exports | 56,813 | 28,186 | 28,627 | 42,893 | 23,815 | 19,078 |
| Domestic consumption | 312,413 | 173,732 | 138,681 | 397,024 | 245,841 | 151,183 |

Clubs and bag, courtesy
A. G. Spalding & Brothers, Inc.

# WHICH CLUB OFF THE TEE?

DRIVER, BRASSIE, SPOON . . . or perhaps even a "5" iron, you choose your club according to the shot you wish to make.

Today it's much the same with aluminum: You choose the alloy, temper and form best suited to each specific job.

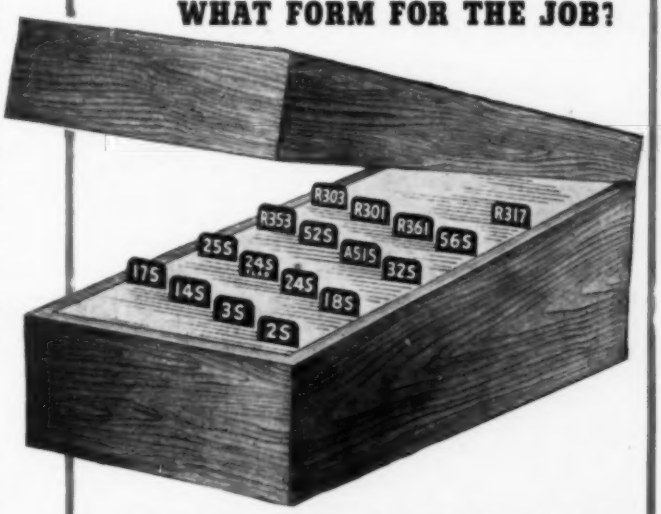
For example, to manufacturers of certain products, high unit-strength is a vital factor. To others, lightness may be even more important. Still others may require superior adaptability to forming or corrosion-resistance; or a combination of qualities.

Use of the *right* aluminum alloy means a better, more serviceable product at lower cost. Reynolds will help you specify it.

**Consider Aluminum . . . Consult Reynolds**

Whatever your interest, Reynolds technicians are ready to cooperate with your engineers. Offices in principal cities. Phone nearest office or write Reynolds Metals Company, Aluminum Division, 2534 So. Third St., Louisville 1, Ky.

**WHAT ALLOY? WHAT TEMPER? WHAT FORM FOR THE JOB?**




**Match the alloy to the job, obtaining the temper needed in the form best adapted to your production. Result: a better product at lower cost.**

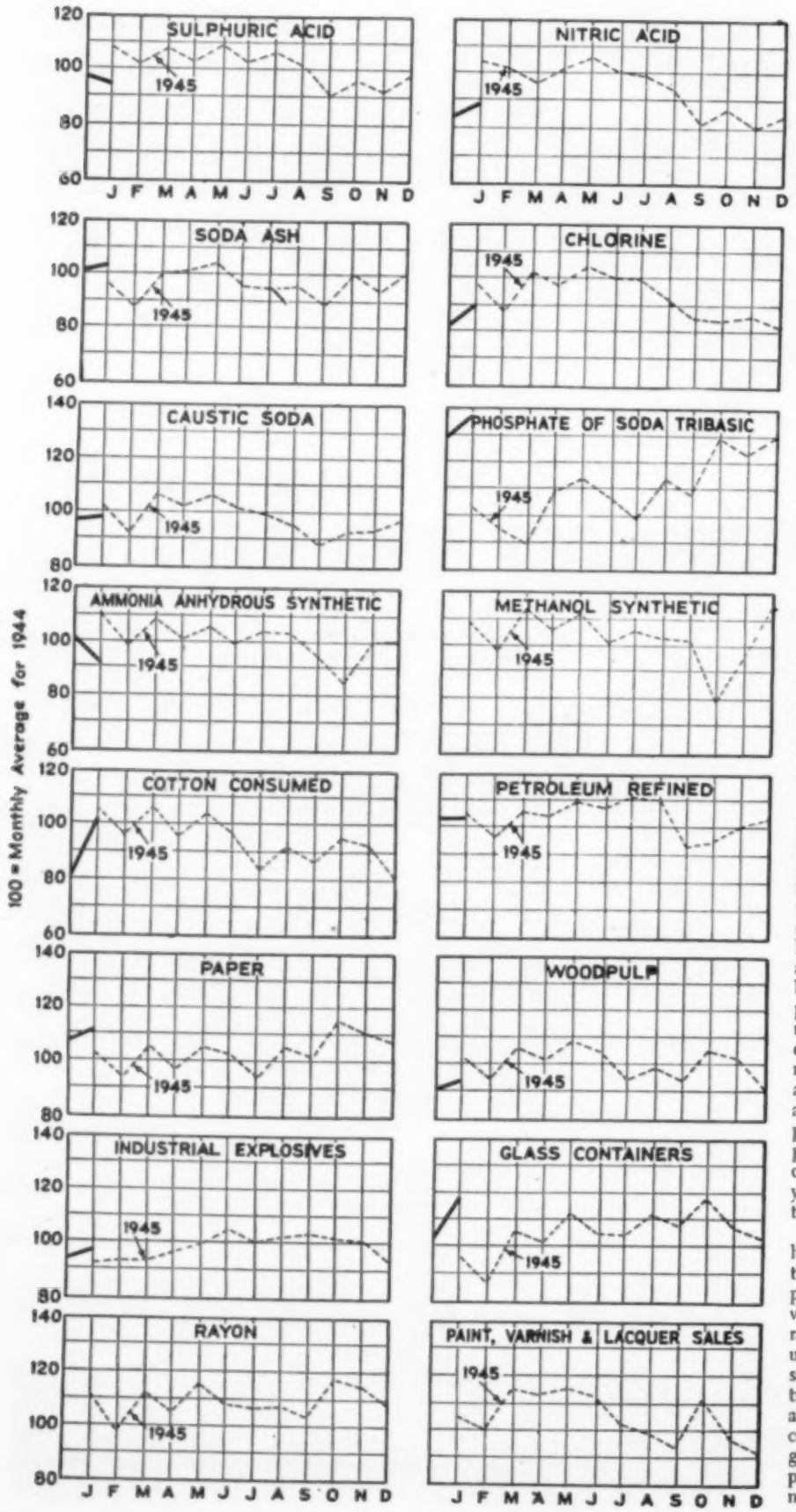
REYNOLDS METALS

# REYNOLDS ALUMINUM

*The Great New Source of*

INGOT · SHEET · SHAPES · WIRE · ROD · BAR · TUBING · PARTS · FORGINGS · CASTINGS · FOIL · POWDER

# PRODUCTION AND CONSUMPTION TRENDS




ALTHOUGH industrial production moved sharply downward in the first two months of this year, the chemical industry did not follow this trend. In the first place chemical manufacturers had very few conversion problems and still more important is the fact that chemicals are essential raw materials for almost all producing industries so that temporary upheavals in some lin's affect only a part of chemical distribution and consumption. However, chemicals have been affected by disturbances in other lines of manufacture. In the current market and for some time back, the law of supply and demand has not been given free rein and demand for chemicals, while relatively large, was halted in some lines, not because the demand did not exist but because other factors prevented its execution.

Recent developments likewise have reacted unfavorably on plans for expansion of chemical plant capacities. Higher wage levels combined with increased costs for steel and other materials have made it necessary to recheck some of the proposed expansion programs and in some cases to defer the time for putting them into operation. More directly affected have been the new projects already started but with building interrupted by inability to obtain delivery of important materials. This may be illustrated in the case of wood rosin where new capacity had been expected to get into operation in the immediate future but a delay of at least two months is now probable before production gets under way. Other new projects involving wood rosin production also are behind their proposed time schedules.

As the prices for most chemicals are frozen, there has been no decided price trend in the market but with few exceptions the underlying tone is firm and it is almost certain that several chemicals would be marked up in price if controls were removed. Production costs, including wage scales and higher prices for raw materials, have risen appreciably and have drawn a very thin line between manufacturing costs and sales prices. In this connection it is worthy of note that a paragraph in the annual report of the E. I. du Pont de Nemours & Co., reads: "Sales prices at the end of 1945 averaged 4 percent below those of 1939, against a 37 percent rise in the national wholesale price average over the same period. Costs of principal raw materials purchased by the company advanced 46 percent over the six-year span, with average hourly wages registering an identical gain."

The long-time trend for chemical prices has been downward due almost entirely to the factors mentioned above. Whether the postwar period will make it necessary to reverse this trend remains to be seen. Temporarily it would seem that many selections under current conditions warrant a higher sales level and that the return of a free trading market would bring this about but a proper balance between production and consuming demand combined with "progressive improvements in manufacturing processes and facilities" is an assurance that no runaway market is in prospect.

# POMONA

***ADJUSTABLE*** You can compensate your Pomona pump for wear—restore proper running clearance when at last it's necessary—by one simple "topside" adjustment. No need to pull the pump to eliminate recirculation; no high adjustment costs—and valuable pumping time is saved!

## *Where there's a well ...here's the way!*

For pumping water from wells, pits, sumps, lakes, rivers, etc., here's the way to cut costs per gallon to the barest minimum—not only in the first year, but for many, many years to come! Pomona vertical turbine pumps have the combination you're after—high, maintained efficiency for continued low power cost, plus lowest yearly maintenance expense!

***NO HIDDEN LEAKAGE!*** Pomona, another product of Fairbanks-Morse, protects your pocketbook against power losses and wasted water with a readily accessible shaft seal, or "packing box." Quick visual inspection and easy maintenance are assured!

***WHAT DO YOU NEED?*** The patented Pomona revolvable, water-lubricated rubber bearing with double (inside and out) bearing surfaces means quiet vibration-free shaft support under all conditions. Fairbanks-Morse vertical turbine pumps are built in sizes from 4" to 36"—with oil or water-lubrication—semi-open or enclosed impellers. Call your nearest Fairbanks-Morse office or your Pomona dealer for information on the pump best fitted to your job.

## FAIRBANKS-MORSE

***A name worth remembering***

DIESEL LOCOMOTIVES • DIESEL ENGINES • MAGNETOS • GENERATORS • MOTORS • PUMPS
SCALES • STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT

## United States Production of Certain Chemicals

December 1945, December 1944 and Totals for the Years 1945 and 1944

| Chemical and Basis | Units | December 1945 | December 1944 | Total, Twelve Months 1945 | Total, Twelve Months 1944 |
|---|---|---|---|---|---|
| Ammonia, synthetic anhydrous[1] | Tons | 45,557 | 50,833 | 548,755 | 543,398 |
| Ammonium nitrate (100% $NH_4NO_3$) | Tons | 39,929 | ..... | ..... | ..... |
| Ammonium sulphate, synthetic (technical) | M lb. | 16,724 | ..... | ..... | ..... |
| Calcium arsenate (100% $Ca_3(AsO_4)_2$) | M lb. | ..... | 1,393 | ..... | 44,350 |
| Calcium carbide (commercial) | Tons | 41,364 | 63,713 | 670,071 | 781,215 |
| Calcium phosphate, | | | | | |
| Monobasic (100% $CaH_4(PO_4)_2$) | M lb. | 5,176 | 4,461 | 62,726 | 60,016 |
| Dibasic (100% $CaHPO_4$) | M lb. | 8,163 | 4,248 | 58,931 | 49,914 |
| Carbon dioxide: | | | | | |
| Liquid and gas | M lb. | 14,926 | 19,142 | 211,912 | 335,203 |
| Solid (dry ice) | M lb. | 42,781 | 39,237 | 646,321 | 550,702 |
| Chlorine | Tons | 94,865 | 107,065 | 1,182,102 | 1,262,226 |
| Chrome green (C.P.) | M lb. | 1,613 | 648 | 9,068 | 6,575 |
| Chrome yellow and orange (C.P.) | M lb. | 4,391 | 3,148 | 44,080 | 34,378 |
| Copper acetoarsenite (paris green) | M lb. | ..... | 538 | ..... | 4,529 |
| Hydrochloric acid (100% HCl) | Tons | 29,037 | 34,346 | 407,598 | 378,273 |
| Hydrofluoric acid | M lb. | 3,053 | ..... | ..... | ..... |
| Hydrogen | M cu. ft. | 1,472,000 | 2,086,000 | 22,227,000 | 24,327,000 |
| Lead arsenate (acid and basic) | M lb. | 5,514 | ..... | 71,014 | ..... |
| Molybdate chrome orange (C.P.) | M lb. | 380 | 105 | 2,280 | 1,340 |
| Nitric acid (100% $HNO_3$) | Tons | 33,033 | 41,328 | 447,082 | 471,335 |
| Oxygen | M cu. ft. | 889,422 | 1,496,821 | 13,923,485 | 18,743,087 |
| Phosphoric acid (50% $H_3PO_4$) | Tons | 68,231 | 58,237 | 717,859 | 691,827 |
| Soda ash (commercial sodium carbonate): | | | | | |
| Ammonia soda process (98–100% $Na_2CO_3$): | | | | | |
| Total wet and dry[2] | Tons | 379,786 | 368,788 | 4,375,017 | 4,538,498 |
| Finished light[3] | Tons | 197,682 | 197,515 | 2,285,726 | 2,455,368 |
| Finished dense | Tons | 128,643 | 124,019 | 1,444,922 | 1,461,832 |
| Natural[4] | Tons | 14,919 | 16,032 | 182,065 | 180,940 |
| Sodium bicarbonate (refined) (100% $NaHCO_3$) | Tons | 16,814 | 13,274 | 174,949 | 157,774 |
| Sodium bichromate and chromate | Tons | 6,769 | 6,854 | 80,672 | 81,977 |
| Sodium hydroxide (100% NaOH)[5] | | | | | |
| Electrolytic process: | | | | | |
| Liquid | Tons | 90,322 | 103,708 | 1,129,141 | 1,205,039 |
| Solid | Tons | 16,549 | ..... | 212,549 | ..... |
| Lime soda process: | | | | | |
| Liquid | Tons | 63,102 | 62,354 | 734,993 | 688,565 |
| Solid | Tons | 16,549 | ..... | 212,549 | ..... |
| Sodium phosphate: | | | | | |
| Monobasic (100% $NaH_2PO_4$) | Tons | 1,189 | 1,141 | 14,783 | 25,716 |
| Dibasic (100% $Na_2HPO_4$) | Tons | 6,094 | 3,951 | 61,254 | 55,804 |
| Tribasic (100% $Na_3PO_4$) | Tons | 8,710 | 6,584 | 88,731 | 80,291 |
| Meta (100% $NaPO_3$) | Tons | 2,538 | 1,699 | 28,934 | 25,541 |
| Tetra (100% $Na_4P_2O_7$) | Tons | 4,268 | 2,645 | 43,447 | 38,757 |
| Sodium silicate (anhydrous) | Tons | 29,276 | 40,901 | 410,669 | 428,353 |
| Sodium sulphate: | | | | | |
| Anhydrous (refined) (100% $Na_2SO_4$) | Tons | 7,205 | 5,576 | 83,201 | 75,482 |
| Glauber's salt and crude salt cake[6] | Tons | 59,786 | 67,490 | 755,125 | 799,596 |
| Sulphuric acid:[4] | | | | | |
| Chamber process (100% $H_2SO_4$) | Tons | 261,541 | 293,503 | 3,069,607 | 3,240,641 |
| Net contact process (100% $H_2SO_4$)[6] | Tons | 439,287 | 483,328 | 5,539,357 | 5,311,681 |
| Zinc yellow (zinc chromate) (C.P.) | Tons | 12 | ..... | 13,316 | ..... |

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census and WPB Chemicals Bureau. Production figures represent primary production and do not include purchased or transferred material. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given, data are either confidential or not yet available.

[1] Includes a small amount of aqua ammonia. [2] Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3] Not including quantities converted to finished dense. [4] Data collected in cooperation with the Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Includes oleum grades. Excludes spent acid.

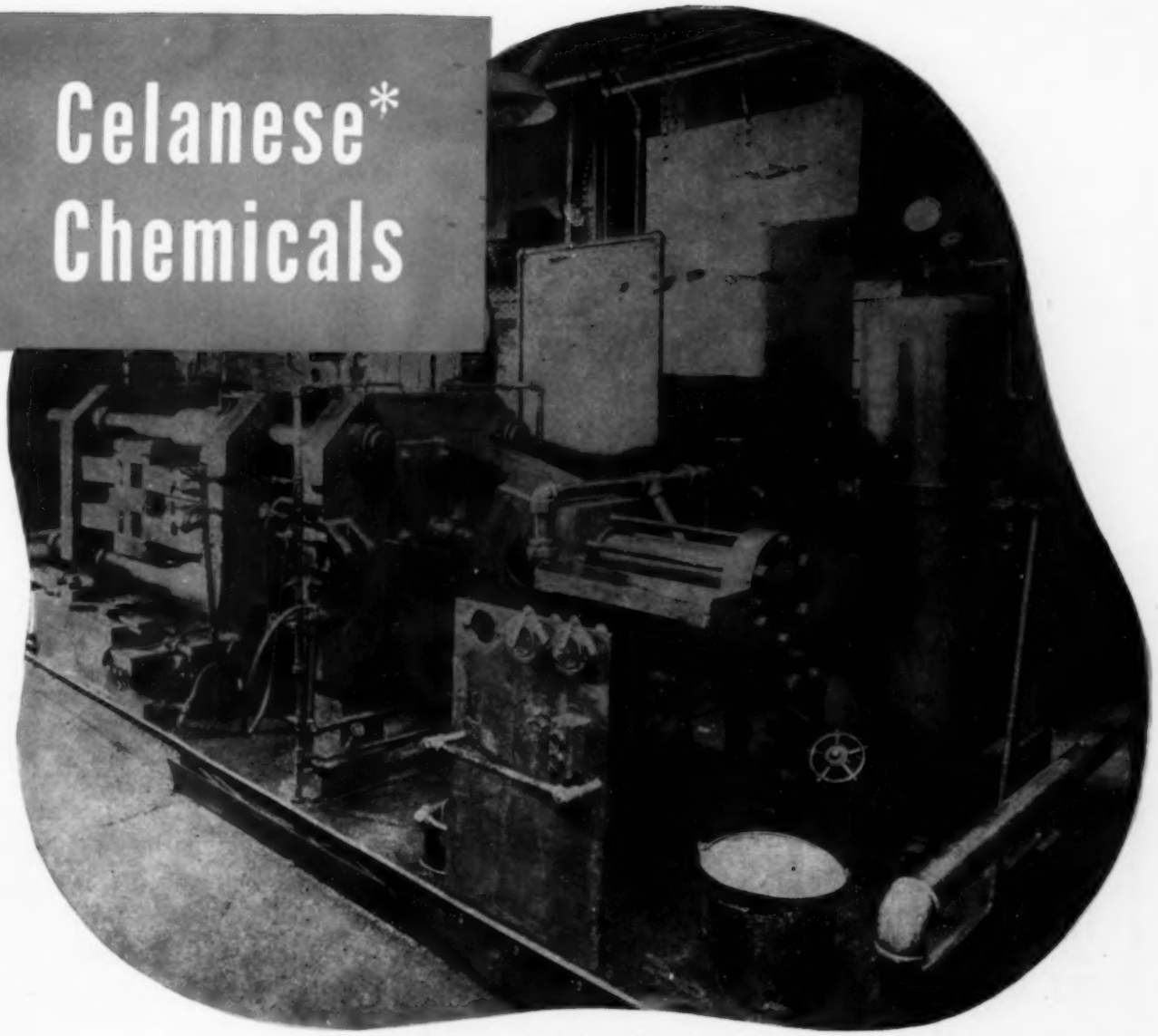
## United States Production of Certain Synthetic Organic Chemicals

November 1945, November 1944 and Eleven-Month Totals for 1945 and 1944

| Chemical | November 1945 | November 1944 | Total, First Eleven Months 1945 | Total, First Eleven Months 1944 |
|---|---|---|---|---|
| Acetanilid, technical and U.S.P. | ..... | ..... | ..... | ..... |
| Acetic acid: | | | | |
| Synthetic[1] | 22,799,014 | 26,451,893 | 243,923,948 | 287,252,380 |
| Recovered | 60,820,900 | ..... | ..... | ..... |
| Natural[2] | 1,942,981 | 3,546,799 | 30,083,652 | 37,250,693 |
| Acetic anhydride[3] | 46,240,884 | 42,326,551 | 481,961,120 | 449,754,459 |
| Acetone | 25,364,281 | ..... | ..... | ..... |
| Aniline | 6,309,175 | ..... | ..... | ..... |

(Continued on page 294)

# Celanese* Chemicals



Diecasting machine in plant of Advance Pressure Castings, Inc., Brooklyn. The non-flammability of Celanese hydraulic fluids eliminates the fire hazard due to line breaks.

## LINDOL* · CELLULUBE* · SAFE HYDRAULIC FLUIDS

Engineers are finding extensive use for the Celanese organic phosphates, Lindol and Cellulube, as hydraulic fluids—particularly in applications where the flammability of mineral oil threatens worker's safety and production. In diecasting, for example, the non-flammability of these compounds virtually eliminates the fires due to line breaks and other causes.

Lindol and Cellulube in addition to their non-flammability are non-oxidizing, non-volatile and exceptionally stable.

The industrial development of the organic phosphates has been the subject of many years' research at Celanese. From limited usefulness these hydrocarbon compounds have been elaborated and refined to a point where they serve a broad range of industrial purposes. Celanese Chemical Corporation, a division of Celanese Corporation of America, 180 Madison Ave., New York 16, N. Y.

PLASTICIZERS
ORGANIC PHOSPHATES
LUBRICANT ADDITIVES
INTERMEDIATES
DYESTUFFS

**Celanese Corporation of America · Textiles · Plastics · Chemicals**

*Reg. U. S. Pat. Off.

## U. S. Production of Synthetic Organic Chemicals (Cont. from p. 292)

| Chemical | November 1945 | November 1944 | Total, First Eleven Months 1945 | Total, First Eleven Months 1944 |
|---|---|---|---|---|
| Acetylsalicylic acid | 966,371 | 774,291 | 9,950,089 | 8,410,947 |
| Barbituric acid derivatives[3] | | | | |
| 5-Ethyl-5-phenylbarbituric acid and salts (Phenobarbital) | 22,873 | 22,463 | 260,900 | 220,298 |
| Benzene: | | | | |
| Motor grade: | | | | |
| Tar distillers[4] | 844,308 | | | |
| Coke-oven operators[5] | 3,728,768 | | | |
| All other grades: | | | | |
| Tar distillers[4] | 1,062,052 | | | |
| Coke-oven operators[5] | 8,997,262 | | | |
| Butyl alcohol, primary, normal | 8,496,807 | | | |
| Carbon bisulphide | 21,528,164 | | | |
| Carbon tetrachloride | 10,752,934 | | | |
| Chlorobenzene, mono | 313,18516 | | | |
| Creosote oil: | | | | |
| Tar distillers[4] | 10,898,407 | 10,262,031 | 117,582,889 | 110,336,609 |
| Coke-oven operators | 2,848,377 | 3,222,103 | 33,095,546 | 38,004,774 |
| Cresols: | | | | |
| Meta-para | 462,570 | 582,474 | 7,288,852 | 6,337,145 |
| Ortho-meta-para | 787,284 | 729,180 | 8,469,917 | 9,256,613 |
| Cresylic acid, refined[7] | 3,572,538 | 3,279,265 | 27,115,924 | 37,648,480 |
| Dibutyl phthalate | 784,737 | | | |
| Dichloro diphenyltrichloroethane (DDT) | 3,371,788 | | | |
| Ethyl acetate (85%) | 6,898,360 | 10,266,097 | 98,544,531 | 98,329,909 |
| Ethyl ether, technical and U.S.P. | 4,476,973 | 6,952,897 | 72,560,576 | 62,883,929 |
| Formaldehyde (37% by weight) | 27,725,786 | | | |
| Methanol: | | | | |
| Natural[8] | 1,867,374 | 2,397,040 | 18,244,734 | 25,530,880 |
| Synthetic | 37,713,847 | | | |
| Naphthalene: | | | | |
| Tar distillers (less than 79° C.)[4] | 16,766,374 | 19,473,424 | 191,028,957 | 185,080,061 |
| Tar distillers (79° C. and over)[4] | 7,677,895 | 6,394,297 | 70,211,467 | 75,921,875 |
| Coke-oven operators (less than 79° C.)[5] | 6,960,925 | 8,427,345 | 80,502,632 | 94,606,324 |
| Penicillin[9] | 820,848 | | | |
| Phenol (synthetic and natural)[7] | 14,262,100 | | | |
| Phthalic anhydride | 7,880,751 | 10,425,671 | 114,756,842 | 113,284,965 |
| Styrene (government owned plants only) | 24,260,551 | | | |
| Sulfa drugs[9] | 476,902 | 319,527 | 5,280,220 | 4,005,268 |
| Toluene: | | | | |
| Coke-oven operators[5] | 1,625,959 | | | |
| All others[4,5] | 1,368,948 | | | |

All data in pounds except benzene (gal.), creosote oil (gal.), toluene (gal.), and penicillin (Million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [3] Excludes the statistics on recovered acid. [4] Acid produced by direct process from wood and from calcium acetate. [3] All acetic anhydride including that from acetic acid by vapor-phase process. [4] Product of distillers who use purchased coal tar only. [5] Statistics are given in terms of bulk medicinals only. [6] Statistics collected by Bureau of Mines. [7] Total production including data reported both by coke-oven operators and by distillers of purchased coal-tar. [8] Reported to U. S. Bureau of the Census. [9] Includes toluene from petroleum.

NO. 6 OF A SERIES OF DIGEST REPORTS FROM CYANAMID RESEARCH LABORATORIES

# A NEW CHEMICAL FOR SYNTHESIS

$$H_2N\text{-}\overset{\overset{NH}{\|}}{C}\text{-}NHCN$$

**AERO* DICYANDIAMIDE**

"Dicy," because of its high nitrogen content (66.67%) and its readiness to react with a large variety of compounds, has held the interest of scientists since its discovery almost a century ago.

Aero Dicyandiamide is a neutral, stable, non-toxic compound now available at a new low price because of Cyanamid's continuing research and broad engineering experience in the field of organic nitrogen chemistry. It may now be considered as a basic raw material, available in commercial quantities.

The outstanding characteristic of "Dicy" is its ability to react with a wide variety of reagents. Reaction may occur either with the amino group or the cyano group, or cyclic products may be formed by reaction with both groups. The following examples are only a few of the more well-known reactions of this versatile compound:

With ammonium or amine salts to give guanidine or biguanide salts.

Under a variety of conditions to produce melamine.

With alkali metal hydroxides to yield metallic salts.

With carbon bisulfide and metal hydroxides to yield salts of ω-cyanoguanidodithiocarbonic acid.

With cyanogen chloride and basic materials to yield salts of 1,3-dicyanoguanidine.

With aldehydes to form resins.

"Dicy" has been suggested as having possible application in many fields—explosives, resins, fire-proofing compounds, dyestuffs, and a host of others. It has been the subject of many patents in a wide variety of fields.

Cyanamid's broad understanding of organic nitrogen chemistry is readily available to your technical staff—address the Synthetic Organic Chemicals Department of the American Cyanamid and Chemical Corporation, 30 Rockefeller Plaza, New York 20, New York, for further technical information and samples.

*Reg. U. S. Pat. Off.*

**AERO DICYANDIAMIDE**
**(Cyanoguanidine)**

| | |
|---|---|
| Formula | $H_2N\text{-}C(:NH)\text{-}NHCN$ |
| Mol. Wt. | 84 |
| Purity | 99% |
| Form | White, crystalline material |
| Solubility | Sol. water, MeOH, liquid ammonia<br>Sl. Sol. EtOH, Acetone<br>V.Sl. Sol. Ether, Benzene |
| Decomp. point | 206-207°C. |

American CYANAMID & Chemical Corporation

(A UNIT OF AMERICAN CYANAMID COMPANY)

*HEADQUARTERS FOR NITROGEN CHEMICALS*

30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

## CHEM. & MET.

## Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

| | |
|---|---|
| **This month** | **109.13** |
| Last month | 109.13 |
| March, 1945 | 108.93 |
| March, 1944 | 109.49 |

## CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to March 11.

### INDUSTRIAL CHEMICALS

| | |
|---|---|
| Acetone, tanks, lb | $0.06 – |
| Acid, acetic, 28%, bbl., 100 lb | 3.38 – $3.63 |
| Boric, bbl., ton | 109.00 – 113.00 |
| Citric, kegs, lb | .20 – .23 |
| Formic, cbys., lb | .10½ – .11 |
| Hydrofluoric, 30%, drums, lb | .08 – .085 |
| Lactic, 44% tech., light, bbl., lb | .073 – .075 |
| Muriatic, 18°, tanks, 100 lb | 1.05 – |
| Nitric, 36°, carboys, lb | .05 – .05½ |
| Oleum, tanks, wks., ton | 18.50 – 20.00 |
| Oxalic, crystals, bbl., lb | .11½ – .12½ |
| Phosphoric tech., tanks, lb | .04 – |
| Sulphuric, 60°, tanks, ton | 13.00 – |
| Tartaric, powd., bbl., lb | .60 – .65 |
| Alcohol, amyl | |
| From pentane, tanks, lb | .131 – |
| Alcohol, butyl, tanks, lb | .10½ – .20 |
| Alcohol, ethyl, denatured, 190 proof | |
| No. 1 special, tanks, gal | .542 – |
| Alum, ammonia, lump, lb | .04½ – |
| Aluminum sulphate, com. bags 100 lb | 1.15 – 1.49 |
| Ammonia, anhydrous, cyl., lb | .14½ – |
| tanks, ton | 59.00 – 69.00 |
| Ammonium, carbonate, powd., casks, lb | .09½ – .10 |
| Sulphate, wks, ton | 28.20 – |
| Amyl acetate, tech. from pentane, tanks, lb | .145 – |
| Aqua ammonia, 26°, drums, lb | .02½ – .03 |
| tanks, ton | 65.00 – |
| Arsenic, white, powd., bbl., lb | .04 – .04½ |
| Barium carbonate, bbl., ton | 65.00 – 75.00 |
| Chloride, bbl., ton | 75.00 – 78.00 |
| Nitrate, casks, lb | .09½ – .11 |
| Blanc fix, dry, bags, ton | 60.00 – 70.00 |
| Bleaching powder, f.o.b., wks., drums, 100 lb | 2.50 – 3.00 |
| Borax, gran, bags, 100 lb | 45.00 – |
| Calcium acetate, bags, 100 lb | 3.00 – |
| Arsenate, dr. lb | .07½ – .08 |
| Carbide, drums, ton | 50.00 – |
| Chloride, flake, bags, del., ton | 18.50 – 25.00 |
| Carbon bisulphide, drums, lb | .05 – .05½ |
| Tetrachloride, drums, gal | .73 – .80 |
| Chlorine, liquid, tanks, wks., 100 lb | 1.75 – 2.00 |
| Copperas, bgs., f.o.b., wks., ton | 17.00 – 18.00 |
| Copper carbonate, bbl., lb | .19½ – .20 |
| Sulphate, bbl., 100 lb | 5.00 – 5.50 |
| Cream of tartar, bbl., lb | .50 – .52 |
| Diethylene glycol, dr., lb | .14½ – .15½ |
| Epsom salt, dom., tech., bbl., 100 lb | 1.80 – 2.00 |
| Ethyl acetate, tanks, lb | .107 – |
| Formaldehyde, 40%, tanks, lb. Works | .032 – |
| Furfural, tanks, lb | .09½ – |
| Glaubers salt, bags, 100 lb | 1.05 – 1.10 |
| Glycerine, c.p., drums, extra, lb | .18½ – .19 |
| Lead: | |
| White, basic carbonate, dry, casks, lb | .08½ – |
| Red, dry, sck., lb | .09½ – |
| Lead acetate, white crys., bbl., lb | .12½ – .13 |
| Arsenate, powd., bag, lb | .11½ – .12 |
| Lithopone, bags, lb | .04½ – .04½ |
| Magnesium carb., tech., bags, lb | .07½ – .08 |
| Methanol, 95%, tanks, gal | .60 – |
| Synthetic, tanks, gal | .24 – |
| Phosphorus, yellow, cases, lb | .23 – .25 |
| Potassium bichromate, casks, lb | .10½ – .10½ |
| Chlorate, pwd., lb | .09½ – .12 |
| Hydroxide (c'stic potash) dr., lb | .07 – .07½ |
| Muriate, 60%, bags, unit | .53½ – |
| Nitrate, ref., bbl., lb | .08 – .09 |
| Permanganate, drums, lb | .19½ – .20 |
| Prussiate, yellow, casks, lb | .16 – .17 |
| Sal ammoniac, white, casks, lb | .0515 – .06 |
| Salsoda, bbl., 100 lb | 1.00 – 1.05 |
| Salt cake, bulk, ton | 15.00 – |
| Soda ash, light, 58%, bags, contract, 100 lb | 1.05 – |
| Dense, bags, 100 lb | 1.15 – |
| Soda, caustic, 76% solid, drums, 100 lb | 2.30 – 3.00 |
| Acetate, del., bbl., lb | .05½ – .06 |
| Bicarbonate, bbl., 100 lb | 1.70 – 2.00 |
| Bichromate, bags, lb | .07½ – .08 |
| Bisulphate, bulk, ton | 16.00 – 17.00 |
| Bisulphite, bbl., lb | .03 – .04 |

## CHEM. & MET.

### Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

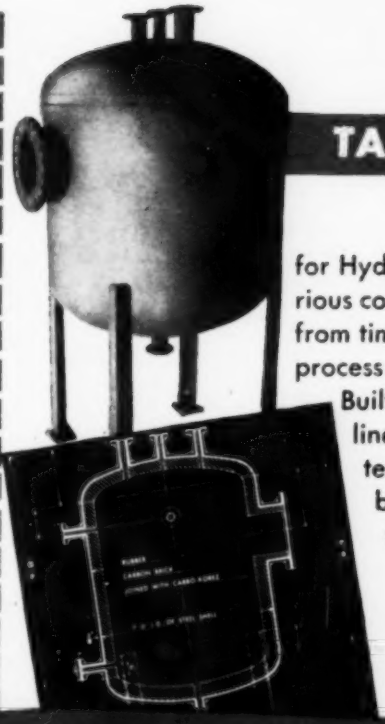
| | |
|---|---|
| **This month** | **145.80** |
| Last month | 145.63 |
| March, 1945 | 145.85 |
| March, 1944 | 145.24 |

| | | |
|---|---|---|
| Chlorate, kegs, lb | $0.06½ – | $0.06½ |
| Cyanide, cases, dom., lb | .14½ – | .15 |
| Fluoride, bbl., lb | .07 – | .08 |
| Hyposulphite, bags, 100 lb | 2.25 – | 2.50 |
| Metasilicate, bbl., 100 lb | 2.50 – | 2.65 |
| Nitrate, bulk, ton | 27.00 – | |
| Nitrite, casks, lb | .06½ – | .07 |
| Phosphate, tribasic, bags, 100 lb | 2.70 – | |
| Prussiate, yel., bags, lb | .10½ – | .11 |
| Silicate, 40°, dr., wks., 100 lb | .80 – | .85 |
| Sulphite, crys., bbl., lb | .02½ – | .02½ |
| Sulphur, crude at mine, long ton | 16.00 – | |
| Dioxide, cyl., lb | .07 – | .08 |
| Dioxide, tanks, lb | .04 – | |
| Tin crystals, bbl., lb | .39½ – | |
| Zinc chloride, grain, bbl., lb | .05½ – | .06 |
| Oxide, lead free, bags, lb | .07½ – | |
| Oxide, 5% leaded, bags, lb | .07½ – | |
| Sulphate, bbl., cwt | 3.85 – | 4.00 |
| **OILS AND FATS** | | |
| Castor oil, No. 3 bbl., lb | $0.14½ – | $0.15½ |
| Chinawood oil, tanks, lb | .38½ – | |
| Coconut oil, Ceylon, N. Y., lb | .0885– | |
| Corn oil crude, tanks (f.o.b. mill), lb. | .12½ – | |
| Cottonseed oil crude (f.o.b. mill), tanks, lb | .12½ – | .12½ |
| Linseed oil, raw, car lots, bbl., lb | .155– | |
| Palm, casks, lb | .0865– | |
| Peanut oil, crude, tanks (mill), lb | .12½ – | |
| Rapeseed oil, refined, bbl., lb | nom | |
| Soybean, tanks, lb | .11½ – | |
| Menhaden, light, pressed, dr. lb | .13 – | |
| Crude, tanks (f.o.b. factory) lb | .089– | |
| Grease, yellow, loose, lb | .08½ – | |
| Oleo stearine, lb | .09½ – | |
| Oleo oil, No. 1, lb | .11½ – | |
| Red oil, distilled, bbl., lb | .13 – | |
| Tallow extra, loose, lb | .08½ – | |
| **COAL-TAR PRODUCTS** | | |
| Alpha-naphthol, crude, bbl., lb | $0.52 – | $0.55 |
| Alpha-naphthylamine, bbl., lb | .32 – | .34 |
| Aniline oil, drums, extra, lb | .11½ – | .12½ |
| Aniline salts, bbl., lb | .22 – | .24 |
| Benzaldehyde, tech., dr., lb | .45 – | .50 |
| Benzidine base, bbl., lb | .70 – | .75 |
| Benzoic acid, USP, kegs, lb | .54 – | .56 |
| Benzol, 90%, tanks, works, gal | .15 – | |
| Benzyl chloride, tech., dr., lb | .22 – | .24 |
| Beta-naphthol, tech., drums, lb | .23 – | .24 |
| Cresol, USP, dr., lb | .10½ – | |
| Cresylic acid, dr., wks., gal | .81 – | .83 |
| Diphenyl, bbl., lb | .15 – | |
| Diethylaniline, dr., lb | .40 – | .45 |
| Dinitrotoluol, bbl., lb | .18 – | .19 |
| Dinitrophenyl, bbl., lb | .22– | .23 |
| Dip oil, 15%, dr., gal | .23 – | .25 |
| Diphenylamine, dr., f.o.b. wks., lb | .25 – | |
| H acid, bbl., lb | .45 – | .50 |
| Hydroquinone, bbl., lb | .90 – | |
| Naphthalene, flake, bbl., lb | .07 – | .07½ |
| Nitrobenzene, dr., lb | .08 – | .09 |
| Para-cresol, bbl., lb | .41 – | |
| Para-nitroaniline, bbl., lb | .42 – | .43 |
| Phenol, USP, drums, lb | .10 – | .11 |
| Picric acid, bbl., lb | .35 – | .40 |
| Pyridine, dr., gal | 1.55 – | 1.60 |
| Resorcinol, tech., kegs, lb | .65 – | .70 |
| Salicylic acid, tech., bbl., lb | .26 – | .33 |
| Solvent naphtha, w.w., tanks, gal | .26 – | |
| Toludin, bbl., lb | .96 – | |
| Toluol, drums, works, gal | .32 – | |
| Xylol, com., tanks, gal | .25 – | |
| **MISCELLANEOUS** | | |
| Casein, tech., bbl., lb | $0.24 – | $0.26 |
| Dry colors: | | |
| Carbon gas, black (wks.), lb | .0365– | .097 |
| Prussian blue, bbl., lb | .36 – | .37 |
| Ultramarine blue, bbl., lb | .11 – | .26 |
| Chrome green, bbl., lb | .23 – | .33 |
| Carmine, red, tins, lb | 4.60 – | 4.75 |
| Para toner, lb | .75 – | .80 |
| Vermilion, English, bbl., lb | 2.50 – | 2.60 |
| Chrome, yellow, C.P., bbl., lb | .16 – | .17 |
| Gum copal, Congo, bags, lb | .09 – | .55 |
| Manila, bags, lb | .09 – | .15 |
| Damar, Batavia, cases, lb | .10 – | .22 |
| Kauri, cases, lb | .18 – | .60 |
| Magnesite, calc., ton | 64.00 – | |
| Pumice stone, lump, bbl., lb | .05 – | .07 |
| Rosin, H., 100 lb | 7.43 – | |
| Shellac, orange, fine, bags, lb | .46 – | |
| Bleached, bonedry, bags, lb | .42½ – | |
| T. N., bags, lb | .35½ – | |
| Turpentine, gal | .93½ – | .94½ |

**TANK**

of welded steel, lined with ATLAS impervious membrane and protected with lining of acid-proof brick, joined with *Carbo*-KOREZ.

Handles Sulphuric acid, several organic acids, organic solvents... and is subject to severe abrasion.



**TANK**

for Hydrofluoric acid and various corrosive salts; also used from time to time for Alkaline process at 230° F.

Built of steel, welded and lined with rubber, protected in turn with Carbon brick joined with *Carbo*-KOREZ.

# *Atlas* CHEMICAL PROCESS EQUIPMENT

## Acid–Alkali–Solvent **PROOF***

*Never ever used PROOF. This ATLAS-Design and ATLAS-Material is PROOF against these elements — not merely resistant to them.

**TRENCH**

...to carry acid wastes for disposal and neutralization. 1200 feet long. Conveys safely corrosive wastes containing Sulphuric acid, Hydrochloric acid, chlorinated organic solvents, alkalis, etc. to the neutralizing system.

This trench does away with danger of acids seeping under buildings, attacking foundations and causing other material damage.

This trench is lined with ATLAS impervious membrane and protected with Acid-proof brick joined with *Carbo*-KOREZ.

Neutralizing equipment is also of ATLAS construction.

*Carbo*-**KOREZ,** in addition to withstanding elements mentioned, stands temperatures up to 360° Fahr.

For help with *your* problem of handling, storing or disposing of corrosives, alkalis, solvents, etc., contact a qualified ATLAS representative at nearest address listed. Write us at Mertztown for Technical Bulletin No. TV-8C.

THE *Atlas Mineral*

**PRODUCTS COMPANY OF PENNA.**

**MERTZTOWN PENNSYLVANIA**

*ATLANTA 3, Ga., 161 Spring St., N. W.
*CHICAGO 1, Ill., 333 No. Michigan Ave.
NEW YORK 16, N. Y., 280 Madison Ave.
*DALLAS 5, Tex., 3921 Purdue St.
PITTSBURGH 10, Pa., 4656 Old Boston Rd.
*DETROIT 2, Mich., 2970 W. Grand Blvd.
SPRINGFIELD, Pa., 355 Fairview Rd.
*KANSAS CITY 2, Kan., 1913 Tauromee Ave.
ST. LOUIS 8, Mo., 4485 Olive St.

THE ATLAS MINERAL PRODUCTS COMPANY OF CALIFORNIA, Redwood City, California

*DENVER 2, Colo., 1921 Blake St.
*SEATTLE 4, Wash., Rensselaer Valve Co., 1252 First Avenue, S.
*HONOLULU 2, Hawaii, U. S. A.
*LOS ANGELES 12, Calif. 817 Yale St.
*Stocks carried at these points

IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, LTD., 977 Aqueduct Street, Montreal, P. Q.

# NEW CONSTRUCTION

| | Current Projects | | Cumulative 1946 | |
|---|---|---|---|---|
| | Proposed Work | Contracts | Proposed Work | Contracts |
| New England | ... | $170,000 | $540,000 | $800,000 |
| Middle Atlantic | $1,500 | ... | 2,196,000 | 1,651,000 |
| South | 22,500 | 3,094,000 | 32,290,000 | 17,253,000 |
| Middle West | 4,000 | 2,314,000 | 10,640,000 | 26,399,000 |
| West of Mississippi | 960 | 10,792,000 | 28,010,000 | 13,230,000 |
| Far West | 500 | 395,000 | 1,625,000 | 4,866,000 |
| Canada | ... | 1,185,000 | ... | 8,633,000 |
| Total | $29,460 | $17,950,000 | $75,301,000 | $72,832,000 |

## PROPOSED WORK

**Ark.,** Little Rock—Consolidated Chemical Industries, 630 5th Ave., New York, N. Y., plan to construct a chemical plant near here. Estimated cost $50,000.

**Fla.,** Jacksonville—Union Bag & Paper Co., Lathrop Ave., Savannah, Ga., has had plans prepared for the construction of a paper mill on the Trout River north of here. Estimated cost $2,500,000.

**Fla.,** Palatka—Hudson Pulp & Paper Co., Palatka, plans to construct a pulp and paper mill. Estimated cost $10,000,000.

**Ga.,** Atlanta—Armstrong Cork Corp., Macon, Ga., plans to construct a pulp and paper mill near Atlanta. Estimated cost $10,000,000.

**Ind.,** East Chicago—St. Clair Refining Co., 3500 Indianapolis Blvd., plans to modernize and construct an addition to its refinery. Estimated cost $3,000,000.

**Md.,** Baltimore—Harbison-Walker Refractories, Farmers Bank Bldg., Pittsburgh, Pa., plans to construct a factory here. D. B. Hendryx, Farmers Bank Bldg., Pittsburgh, Cons. Eng. Estimated cost $500,000.

**Minn.,** Winona—Northwest Cooperative Mills, 739 Jackson St., N. E., Minneapolis, plans to construct a fertilizer plant. Feldhausen & Coughlen, Columbus Bldg., Green Bay, Archts. Estimated cost $400,000.

**N. J.,** Paulsboro—Socony Vacuum Oil Co., Inc., plans to construct chemistry and physics buildings and pilot plant for lubricating oil at research laboratories. Estimated cost $1,000,000.

**O.,** Akron—Goodyear Tire & Rubber Co., Akron, plans to construct a 2 story, 100x340 ft. plastics manufacturing plant. J. Gordon Turnbull, Inc., 2630 Chester Ave., Cleveland, Cons. Eng. Estimated cost $1,000,000.

**Ore.,** Nyssa—Amalgamated Sugar Co., Nyssa, plans to construct an addition to its sugar factory and also an acid plant. Estimated cost $250,000 each.

**Tex.,** Dallas—Atlantic Refining Co., Magnolia Bldg., Dallas, Tex., plans to construct an industrial building on Mockingbird Lane, also one on Lemmon St. Estimated cost $250,000 and $60,000 respectively.

**Tex.,** Waco—Chlorine Solutions Co., c/o J. Pierson Kittress, plans to construct units 2 and 3 of new manufacturing plant. Estimated cost $100,000 each.

## CONTRACTS AWARDED

**Ala.,** Mobile—National Gypsum Co., Baker St., has awarded the contract for an addition to its wallboard plant to Kerby-Saunders, Inc., 330 West 42nd St., New York, N. Y., at $860,000.

**Ala.,** Mobile—Southern Kraft Paper Co., subsidiary of International Paper Co., will construct an addition to testing and research laboratory and general improvements to plant. Work will be done by day labor and subcontracts. Estimated cost $1,050,000.

**Ala.,** Tuscaloosa—Placid Oil Co., Shreveport, La., will construct an oil refinery. Work will be done by day labor and subcontracts. Estimated cost $750,000.

**Calif.,** Anaheim—General Electric Co., 212 North Vigne St., Los Angeles, has awarded the contract for a chemical factory for the manufacture of glyptal alkyd resins to Blaw-Knox Construction Co., 136 N. Los Angeles St. Estimated cost $250,000.

**Calif.,** Wilmington—Pacific Coast Borax Co., Berth 166, will construct an ore bin, conveyors, etc., here. Work will be done by owner. Estimated cost $100,000.

**Ga.,** Atlanta—Lane Drug Co., Courtland and Pine Sts., N. E., has awarded the contract for a 3 story addition to its warehouse to Ralp Didschuneit, Chandler Bldg., at $94,000.

**Ill.,** Chicago—Kohl Potteries, Inc., 2050 West 59th St., has awarded the contract for a factory to Martin J. Ingram, 228 North La Salle St., at $44,000.

**Ind.,** Whiting—Standard Oil Co. of Indiana, 910 South Michigan Ave., Chicago, Ill., has awarded the contract for laboratory research buildings to Gust K. Newberg Co., 9 South Clinton St., Chicago. Estimated cost $2,000,000.

**Me.,** South Brewer—Eastern Corp., has awarded the contract for a paper mill laboratory here to T. W. Cunningham, Inc., 84 Harlow St., Bangor. Estimated cost $50,000.

**Mass.,** Arlington—Frost Insecticide Co., 24 Mill St., has awarded the contract for a 2 story warehouse to Elmer V. Tefer, 312 Salem St., Medford. Estimated cost $40,000.

**Mass.,** Attleboro—Standard Plastics Co., 62 Water St., has awarded the contract for factory additions to Swanson Construction Co., 89 County St. Estimated cost $40,000.

**Mass.,** Peabody—Kirstein Tanning Co. has awarded the contract for the construction of a factory to E. H. Porter Construction Co., 15 Wallis St. Estimated cost $40,000.

**Minn.,** Minneapolis—Stewart Paint Manufacturing Co., 1730 Washington Ave., N., has awarded the contract for a factory and warehouse to E. M. Ganley Co., 2922 Oakland Ave. Estimated cost $150,000.

**Mo.,** Wellston (St. Louis P. O.)—Lever Bros. Co., 50 Memorial Dr., Boston, Mass., has awarded the contract for the design and construction of the first unit of a soap and soap products manufacturing plant in St. Louis Co., to Stone & Webster Engineering Corp., 90 Broad St., New York, N. Y. Estimated cost $10,000,000.

**N. C.,** Charlotte—Linde Air Products Co., 30 East 42nd St., New York, N. Y., has awarded the contract for a factory here to A. H. Guion & Co., Wilkenson Blvd.

**O.,** Cleveland—Tropical Paint & Oil Co., 1246 West 70th St., has awarded the contract for a new storage, shipping and receiving building to Charles A. Burton, Inc., 1836 Euclid Ave. Estimated cost $75,000.

**O.,** Columbus—M & R Dietetic Laboratory, Inc., 585 Cleveland St., has awarded the contract for a 1 story warehouse to E. Elford & Son, 555 South Front St. Estimated cost $55,000.

**O.,** Waterville—Glass Fibers, Inc., has awarded the contract for 2 factory buildings to Geo. W. Lathrop & Sons, 1510 Montcalm St., Toledo. Estimated cost $100,000.

**Tenn.,** Kingsport—Tennessee Eastman Corp. has awarded the contract for a 2 story addition to plant to Johnson & Willard, 422 West Front Ave., Knoxville, Tenn. Estimated cost $300,000.

**Tex.,** Dallas—Atlantic Refining Co., Magnolia Bldg., will construct laboratory and shop building with own forces. Estimated cost $392,000.

**Tex.,** Houston—Shell Refining Co., Deere Park, has awarded the contract for an addition to its plant to J. A. Jones Construction Co., Scanlan Bldg. Estimated cost $90,000.

**Tex.,** Waco—Chlorine Solutions Co., c/o J. Pierson Kettess, will construct first unit of manufacturing plant. Work will be done by force account and subcontracts. Estimated cost $160,000.

**Wash.,** Bellingham—Pacific Coast Paper Mills, Inc., has awarded the contract for a 2 story addition to paper mill to Howard S. Wright Co., 407 Yale Ave., N., Seattle. Estimated cost $45,000.

**Wis.,** Oshkosh—Wisconsin Liquor Co., 715 Ohio St., has awarded the contract for warehouse and office building to B. B. Ganther Co., 78 State St.

**Ont.,** Waterloo—Jos. E. Seagram & Sons., Caroline St., has awarded the contract for an addition to its plant to Ball Bros., Ltd., 49 King St., E., Kitchener. Estimated cost $180,000.

**Que.,** Riviere Pentecote—Canadian International Paper Co., Sun Life Bldg., Montreal, has awarded the contract for a pulpwood site, including power house, wharf, etc., to Wm. Harney, 105 Cote de la Montagne. Estimated cost $561,300.

**Que.,** Ville La Salle—Mallinckrodt Chemical Works, Ltd., 378 St. Paul St., W., Montreal, has awarded the contract for an addition to its plant to James W. Ross, 1010 Ste Catherine St., W., Montreal. Estimated cost including equipment $443,560.